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AMERICAN POTASH INSTITUTE, INC.

INVESTMENT BUILDING **WASHINGTON, D. C.**

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: Investment Bldg., Washington, D. C.

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WHERE CONTENTMENT REIGNS SUPREME.

Better Crops with PLANT FOOD

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An Explanation of what makes people—

Too Goofy to Grumble!

Jeff McDermid

NOW that summer is upon us in all its warmth and fervency, we can put aside the dreary evening paper and the stuffy economic and financial digests which we endured for want of livelier company beside the winter hearth.

Perhaps you share my cheerful resignation in the pleasant thought that although depleted in cents and none too rich in sense, we happily possess our normal *senses*. That is wealth indeed, but too often carelessly despised—and nowhere in the season's round of wakefulness do we have the chance to use them more than in the too brief summer interval which now enthralls us.

Not long ago I heard a noted cooperative spokesman tell his loyal fellow crafters that what we need most of all is a greater awareness of and a sturdier belief in our blessedness as native-born Americans.

He then removed his coat and vest to give free play to histrionic exercise and unbuckled his belt to give full belly tone to his deeper verbosity—and proceeded to make us all ashamed of Wall street and the jittery stock jobbers who seem to do all our economic barometric reading for us. He reminded us of the present and future wealth and resources of our broad land and the numerous advantages we have compared to millions in the murk of old world misery.

But somehow he overlooked the simplest and most comforting things which healthy folks enjoy in summer time—the period of general rejuvenation, of

resurrection, of deep outdoor breathing and wide visions beyond the hills, of all things most treasured by ordinary Americans whose supply of political economy and economic lore is worn pretty thin after imbibing a whole winter's pharmacopœia of contradictory doctrines and frustrated theories.

Before the advent of those lengthy stock quotations in every small-town newspaper and prior to the blatant radio financial dopester, most of us came through the indoor confinement spell with nothing worse than boils and bilious indigestion. Mother had her stock of natural and artificial remedies and condiments with which to assuage our alimentary ailments. We had plenty of pie plant growing tall and tender under an old nail-keg, with which to activate our bowels and enliven our livers. There was an overabundance of sprouting asparagus tips ready to be nipped off and stewed up in butter for the welfare of our sluggish bladders. And sundry potent patent solutions and tablets peddled over the countryside by the same wagon man who also sold Father his horse liniment and louse powder were toted out of the kitchen cupboard to be taken "infernally" in deference to the summer moon.

"MORE than like as not," as Uncle Jarvis used to say, it was the salubrious breath of summertime and not the dope we swallowed so unwillingly which had us playing leap-frog so soon after a winter of inertia. My only point in dragging in the old medicine chest is not to advocate its present use to cure the "recession mania," but to emphasize the fact that nearly all our fancied disturbances in those days were physical reactions and not mental ones caused by morbid concentration on the "state of the nation."

Aside from a little red fire and blatherskite in the campaign of 1896 when a lot of us thought the free silverites and populists would capture the capital, I do not recall our pondering over much on the condition of the country at large. My Father thought, and pounded the table in defense of his hunch, that if we kept the dear old protective tariff and outvoted the A. P. A. outfit we were on the road to salvation. We imagined we did fairly well to elect decent town selectmen and keep our bills paid up, to say nothing about taking in any of the nation's worries.

NOW I am fully cognizant that you are going to say we were all so dumb and indifferent to what was going on in those times of "innocuous desuetude" that we let this fair land of ours drift into the bow-wows, while we drank Botchkin's Elixir with one hand and turned the ice-cream freezer with the other. It's bad to be put on the defensive so soon.

I know without asking—I can see it in your superior "seminar" smile—that you intend to charge us youngsters with being such introverts that we let the extroverts get a mean holt on us for a tough fall. I am sure you have it ready to spring on me that we let the communists in through the open door and shut out Secretary Hull's world trade; and that our ignorant, blissful, daisy-plucking dream (like that of Ferdinand the Bull) has turned into a graphic nightmare, with rip-snorting "repercussions" and may be just a few plain kicks in the pants!

You would have us keep that world almanac and the chart of ups and downs right before us while we sow and reap and play horseshoes and dive off the spring-board. But, no thanks! I prefer to take a mental vacation from that, for this is what summer's made for!

One of my rollicking friends observes drolly that if all the economists were placed end to end they would reach to no conclusions! At any rate, that's about as far as most of us can reach when we abandon ourselves to a spree of worrying why the world doesn't run like it "used to could." As a matter of fact, folks who keep close partners with nature don't notice much change.

MY MOTHER got a picture of Helen Keller a long time ago, and she framed it to hang in the hallway. She always thought Helen Keller was the greatest person who ever lived, and I doubt if she would change her mind today even for the sake of paying homage to Mrs. Dionne of Callander, Dorothy Thompson, or Snow White! Mother was always idolizing folks who

rose above tough breaks, maybe because she didn't always have the strength to overcome the jokes that fate slipped to her—like myself perhaps! Blind Tom, the untaught plantation pianist, whom she heard in a concert back in the seventies, was another scrapbook hero of hers. Anyhow, her instructions to us family folks were that every time we came home with a heavy heart or a bad grouch, or when we heard some bad news—like a case of measles in the neighborhood or a Democrat landslide —that we must pause after hanging up our wraps and take a good, long look at Helen Keller there in the walnut frame.

If that didn't fetch us around, she would take more drastic remedies, such as sulphur and molasses! It appears to me that herein I have given the world about as good an anchor to windward as many economists can furnish in case of a storm. Seems to me as though we might even start a campaign to place a Keller chromo in every home, with sulphur and molasses kept in reserve for the ones who listen too long to bewailers and bewarers.

Is the world getting sophisticated to a point where we find fewer and fewer folks of the good old kind we used to neighbor with, who were too happy to holler for help and too goofy to grumble about their lack of luxury?

Has our higher average level of learning put us in closer touch with the mysteries of nature only to reduce our thinking to skepticism and morbid fear? Were the old-timers better equipped mentally and spiritually to stand a siege despite their haphazard methods and groping guess work? Is it not also true that most jobless folks on relief fare better today than did two-thirds of the upper crust of our country less than fifty years ago?

Even such a realistic business booster as Roger Babson thinks that what we need most now is mutual confidence in each other, less class selfishness, and a genuine spiritual regeneration. I interpret that sentiment to mean that we should fret and fume less about what we hope to have tomorrow and just lean back and light our last cheroot like a busted sport, in contemplation of the fine possessions we enjoy already. This would include the three godsends which noble Helen Keller never had—sight, speech, and hearing.

YET far be it from me to league myself or attach my philosophic kite to the dubious doctrine of the w. k. brass monkeys—for it is a negative virtue just to abstain from seeing, speaking, or hearing evil or foreboding. Because a fellow who closes his senses to unworthy things or refuses to admit that everything is not ideal, may not be able to impart the better things his senses tell him in such a way as to render the most good to the most unfortunate.

In my way of looking at it the most unfortunate are the ones who must live in huddled cities. It has always seemed

(*Turn to page* 47)

A Balanced Fertilizer For Bright Tobacco

By E. M. Matthews

Superintendent, Agricultural Experiment Station, Chatham, Virginia

TOBACCO growers are unanimous today in their recognition of the important part which fertilizers play in producing profitable yields. They are not, however, unanimous in their knowledge of the functions performed by the different ingredients making up their mixed fertilizer; or what is necessary to provide a balanced plant-food ration for bright tobacco on new and on old soils, in wet and in dry seasons; or what part fertilizers may play in influencing yield and quality of tobacco and in increasing or decreasing the chances of damage from many common disease and malnutrition troubles.

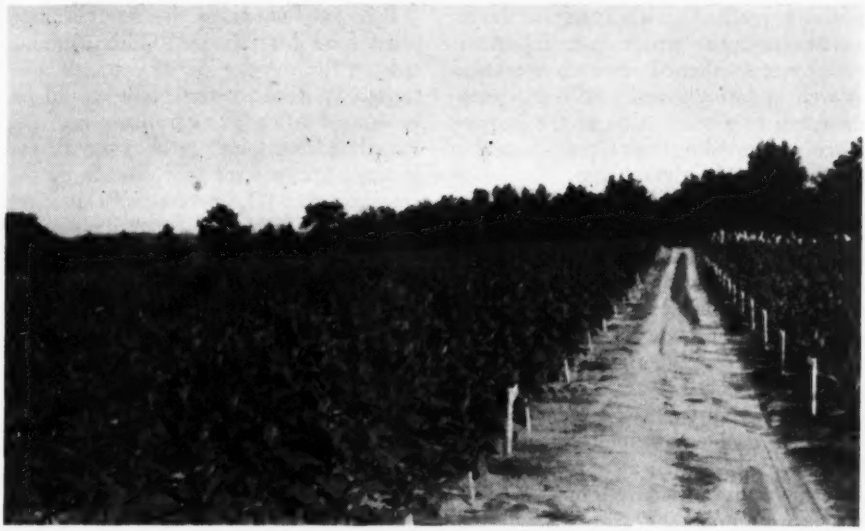
It is with a view in mind of answering some of these questions, and so far as possible (based on results measured by actual tests conducted on the Agricultural Experiment Station in Virginia) showing to what extent varying the fertilizer analysis, source of materials, and rate of application influences the money returns per acre for this important crop, that this discussion is given.*

Few crops respond so readily and depend so completely on the plant food supplied by fertilizer applications as does bright flue-cured tobacco when grown on typical bright tobacco soils. During the early years of tobacco growing in Virginia, most planters depended largely upon the natural fertility of the virgin soils. Later animal manure was used to add extra plant food and boost yields. When the old fields would no longer produce crops of quality tobacco, these early planters sought the new lands of Piedmont Virginia. These virgin fields when first cleared of trees were rich in many of the plant-food elements so essential for healthy tobacco growth; such plant foods as magnesium, potash, organic nitrogen, and probably many others in minor quantities. Early in the history of bright-tobacco production it was discovered that most of these new soils just cleared for tobacco growing were too deficient in phosphoric acid for proper growth and early ripening. Consequently the use of phosphoric acid in fairly liberal applications was soon considered essential and was recommended.

Quality—an Early Factor

Before commercial fertilizer mixtures were generally used, tobacco growers acquired the practice of using stable manure for tobacco. This manure supplied ample nitrogen, small quantities of phosphoric acid, and considerable potash to supplement the diminishing supply of natural plant foods removed from the soil by successive tobacco crops. Peruvian Guano, a complete organic fertilizer, was widely used in early days.

* AUTHOR'S NOTE: The present article dealing with fertilizing bright tobacco is intended to supplement the information given by the writer in a previous article entitled "Virginia Tobacco Needs Potash," which was published in *Better Crops* in February 1936. It is, therefore, suggested that all interested readers obtain a copy of the former discussion to read as an introduction to the present discussion and recommendations.



General view of tobacco plots at Chatham, showing seed plants in the far right covered with bags to prevent crossing of the several varieties. Potash and nitrogen variation plots are on the right in the foreground.

As early as 1880 a bulletin on growing and "Curing Fancy Yellow Tobacco" by E. L. and F. P. Love of Pittsylvania County, Virginia, said in part: "This plant is like the butter-weed crop, in that it flourishes best in topsoil. To grow it fine and house it early, don't stir up the clay which is hostile to the growth of fine tobacco. A lump of clay large as a hen's egg at the root of a plant of tobacco will cause it to grow coarse and mature late. It matters not how fine you break the top-soil, the finer the better, but do not plow deep enough to reach the clay. . . . Guano should be used in the hill to the extent of a handful to every three hills on thin land. If the land is strong use a spoonful to the hill."

The Guano referred to was no doubt Peruvian Guano which was extensively used in Virginia about that time. In 1879 Virginia spent $2,000,000 for fertilizer, while the United States spent only $28,000,000, compared with expenditures 40 years later of $17,000,000 by Virginia and $326,000,000 by the United States.

The need for extra phosphate, as well as nitrogen and potash, became so universally apparent with tobacco growers that by 1875 or 1880 commercial fertilizer mixtures containing nitrogen and phosphoric acid, and in some cases small percentages of potash from wood ashes or kainit, were prepared and sold to tobacco growers.

Potash Need Appears

In the early days of fertilizers for bright, flue-cured tobacco, when small yields were expected from wide-spaced planting, low topping, and the whole-stalk method of harvest, a mixture containing 2 per cent nitrogen and about four times as much, or 8 per cent, phosphoric acid was found to produce the best quality of yellow, easily-ripening, cigarette tobacco. Since chemical analysis showed that most of the better tobacco soils contained large quantities of total potash (often 15,000 to 40,000 pounds of K_2O per acre for the top 8 inches of soil), very little thought was given to the actual potash needs of the tobacco plant, hence a 2-8-2 fertilizer was thought ample and complete for bright tobacco. Not until closer spacing, higher topping, and harvesting by the

priming method, with resultant large yields, have the severe potash-hunger symptoms awakened research workers, as well as farmers and fertilizer manufacturers, to a realization of the importance of providing more potash in the fertilizers for bright tobacco.

Severe symptoms of deficiencies in other elements, such as magnesium and in some cases calcium, boron, and others have also developed, and consequently the agricultural experiment stations throughout the tobacco belt have been and are continuing to run hundreds of field and laboratory tests to help find answers to many of these old and new nutrition problems which confront tobacco farmers. As a result of these investigations and based on the findings throughout the several States, a committee of agronomists and other research workers from the various stations meets annually to make recommendations for fertilizing bright tobacco. It is with a view to explaining these recommendations, as well as to offer a few experimental results in support of the same, that the writer makes this discussion.

First, let us review the principal functions of the five or six major plant-food elements for tobacco:

Nitrogen: Without nitrogen in our fertilizers we get very little growth. This element is probably the most important element for boosting fast growth and supplying the dark green color. However, it was early found important that soils which were fairly deficient in natural organic nitrogen be used, and that care be exercised not to make available to the tobacco plants an over supply of nitrogen, particularly during the ripening stages of the crop.

Phosphoric Acid: Although the tobacco plant uses only a small quantity of phosphoric acid, yet a fairly large supply of this element is necessary for the proper growth and ripening of tobacco. Phosphoric acid hastens maturity and ripening of the leaf. Without it tobacco grown on most soils remains small, with dark green and narrow leaves which never ripen.

Potash: Potassium is an essential plant food for tobacco. This element aids in the development of starch and sugar. Without it the plant would be weakened and make very little growth. Potash adds much to the yield of tobacco, improves the leaf quality by increasing the oil, sweetness, elasticity, and general smoothness, and makes it more healthy and vigorous to withstand certain leaf diseases.

Magnesium, Calcium, Iron, Boron, and others: Magnesium, although required in fairly small quantities, is an essential plant food for tobacco. Without this element the leaf bleaches out and wastes away before maturity. The pale, almost white, and thin undeveloped leaves (known as Sand-drown) near the bottom and middle portions of the plant are typical magnesium deficiency symptoms.

Calcium deficiency produces small, dwarfed plants, light in weight, with poor root development. The effect of a deficiency in boron is similar to that of calcium, except that the plant appears more drawn near the top, with the terminal bud finally dying in extreme cases. Where sulphur or iron is deficient, the plant is also stunted in growth.

Of all the above-mentioned elements essential for growth of the tobacco plant, probably potash has been most neglected in being supplied in sufficient quantities by Virginia bright-tobacco producers. For this reason the writer in this article endeavors to give slightly more emphasis to study and discussion of the potash requirements for tobacco than is given to the others.

Different authorities give rather widely varying figures on the amount of plant food removed from the soil by an average crop of tobacco. Such figures from literature reviewed vary from 38 pounds of nitrogen, 5 pounds of phosphoric acid, and 57 pounds of potash, to 127 pounds of N, 32 pounds of P_2O_5, and 148 pounds of K_2O. However, based on actual analysis of the tobacco plant under average conditions, we find that a 1,000-pound crop of to-

bacco leaves removes from the soil approximately 40 pounds of N, 5 pounds of P_2O_5, and 60 pounds of K_2O; and if the stalks are also removed from the field, the total plant food then removed would be approximately 47 pounds of N, 7 pounds of P_2O_5, and 77 pounds of K_2O.

1,000 pounds leaf (alone) remove 40 lb. N, 5 lb. P_2O_5, 60 lb. K_2O.

1,000 pounds of 3-8-3 supply 30 lb. N, 80 lb. P_2O_5, 30 lb. K_2O.

Difference: 10 lb. N, + 75 lb. P_2O_5, — 30 lb. K_2O.

The above shows that 1,000 pounds of 3-8-3 fertilizer contain ample phosphate but lack 10 pounds of nitrogen and 30 pounds of potash in supplying as much of the three major plant foods as a 1,000-pound crop of tobacco removes, provided all stalks and roots are left on the field. This slight deficiency of nitrogen can usually be supplied by organic nitrogen received from weed growth or other organic material plowed under; however, this is not always possible, especially on sandy soils where there is little organic matter and leaching is bad. Lack of nitrogen may often limit the yield on tobacco fields where only 30 pounds of nitrogen are applied per acre.

In nearly all cases, where only 30 pounds of potash are supplied by 1,000 pounds of a 3-8-3 mixture (particularly on typical tobacco soils where tobacco is grown year after year), the 30-pound shortage will greatly limit the yields and quality of the crops grown. With some growers who produce on good deep sandy soils as much as 1,200 to 1,600 pounds of smoking leaf per acre, the potash requirement would be from 70 to 96 pounds per acre for the leaf alone.

On new soil rich in potash reserve, or on farms when a 2- or 3-year rotation is practiced with heavy weed and fallow crops turned under before each tobacco crop, this potash supply of 30 pounds may prove sufficient, and particularly is this true where low topping and wide spacing are practiced and small yields of cutting-type tobacco are expected.

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Note the rough, crinkled leaves and dead areas of the plant on the right which received no potash. These are typical potash starvation symptoms.

Looking down over the small flower garden showing the roses in bloom and the winding driveway as it starts from the top of the hill to reach the valley below.

Advantages of Living On Your Own Farm

By E. B. Ferris

Superintendent, Holly Springs Branch Experiment Station, Holly Springs, Mississippi

BEFORE the Civil War, the average Southern land-owner and planter lived on his farm and had that intimate knowledge of its every detail that the present merchant or manufacturer has of his store or factory. It is true that the larger ones among these planters had their overseers or managers. But as one who was reared on the plantation of his grandparents so soon after this war as to have made the relationship between former master and slave seem all but a reality, such overseer only represented the master in minor details, had no authority to punish the slaves or to decide matters of policy. All of this was left to the owner of the farm who knew the peculiar needs of every field and even the strength or weakness of every slave or work animal. The mistress, too, on such a plantation, largely supervised the making of the clothes, looked after the health of the family, including the slaves, and saw to the beautification and upkeep of the home in the broadest sense that the word implies.

Under such a system of careful planning and overseeing, there is no wonder that many of these homes which still stand are now monuments to the high rural civilization of the Old South. Pilgrimages to such places as the country around Natchez, Mississippi, where invading armies did not destroy the old homes, are attracting annually thousands of visitors who come to see the beauty of the old gardens, the

majesty of the old houses, and the exquisite taste employed in the selection of the furnishings. In the opinion of the writer, no rural civilization, past or present, ever surpassed that of the Old South immediately preceding this Civil War, and it was largely due to the fact that our forefathers lived on their farms and that every member of the family did his or her part toward the upkeep of the land from which their wealth was derived.

The Trek from the Land

Following this war, these old families, as a matter of protection to themselves, largely moved to nearby towns and cities or to distant States. They left their farms to the tender mercies of the former slaves, for whom we entertain none but the kindliest of feelings, realizing that they were themselves the victims of circumstances beyond their control as were also their masters. But the 70 odd years that have intervened now find the North and South entirely reconciled, with the farms of the South the main sufferers by reason of the fact that far too large a part of their owners live away from the land and cannot possibly give that intimate supervision necessary to the best farm husbandry. It is true that many of our Southern people, in the generation rapidly passing, grew up with a false interpretation of what constituted a real gentleman or lady and feeling that any sort of manual labor was beneath the dignity of their class, but this has long since become a thing of the past and is no longer a handicap.

As a representative of a generation that possibly had been imbued with the most of this false pride, we wish to pay tribute to the example and teaching of one who was the personification of the Old South and, following the Civil War, devoted his energies to the training of Southern youth. We refer to General Stephen D. Lee, the first president of the Mississippi Agricultural and Mechanical College, who did more than any other man of his generation, especially in the lower South, to teach the dignity of honest toil and to train the youth of the land how to work with their hands as well as their heads. As old age approaches, we come more and more to appreciate the privilege of having been one among the thousands of Southern youth who received training under him and especially to remember the encouragement he gave to the poorer boys, among whom we were numbered, in teaching us to hold up our heads and forget the troubles of the past.

But even General Lee was not able in a generation to restore the modes of living in the Old South and especially to send the farm youth back to the land, for it is a task that will require the efforts of many generations. One can destroy in a decade what it will require centuries to restore, if, indeed, it can ever be wholly accomplished. As a matter of fact, 1938 finds the South with far too large a part of its land-owners living off the farm, and the object in preparing this article is to give the public our personal experience as to the many advantages of living on our land.

A Move Back to the Land

Long the owner of Southern farm land, we trusted its upkeep to the mercies of ordinary negro tenants, feeling that we owed too much to the family to move them miles away from the nearest town and on to this farm. Only circumstances beyond our control forced this move back to the land during the height of the recent depression and under conditions far worse than the average. The most agreeable surprise came in the satisfaction of the family and the way each and every member took hold and helped to make it a success. On a plantation where, even before the Civil War, a white family had never lived, 16 miles from the market town, with no building of any kind except the worst type of negro cabins, we took this family after building the cheapest kind of residence, so placed as to take full advantage of the natural

landscape, and otherwise a place where it required a vivid imagination to foresee happiness and contentment.

Under the old regime this place had never produced anything of money value but cotton, and barely enough to support the tenants and pay the taxes. There was no livestock except the mules required to make the cotton and never enough corn grown to feed these mules, making it necessary every year to purchase fully half of the feed. Simply as a result of closer supervision of the tenants by being always present and by a more intimate knowledge of the lands best suited to cotton, corn, and pastures, the family has been able to practically double the production of cotton on 35% less land than had previously been devoted to it; to increase the production of corn almost tenfold; and to set aside all the very poor acres for summer legumes and all the land inclined to erode or to be too wet for cultivation, for pasturage. On this land are kept 75 to 100 breeding cows, 50 to 60 head of sheep, 12 to 15 brood mares, about a dozen brood sows, and enough goats to keep down shrubbery when once the pastures are cleared of timber and old fields consolidated from the neglect of previous inattention. Winter feed for all has been grown largely on land taken out of cotton.

Thus, instead of cotton alone as a money crop, they have introduced the sale of appreciable numbers of hogs, possibly $1,000 worth a year; many baby beeves; some lambs and wool; and at least enough mule colts to do away with the necessity for buying older ones every year. Large acreages of bur clover have been planted both for pasture and for soil building, the hope being that this crop may be substituted entirely for other winter legumes and do away with the necessity of buying vetch or winter pea seed annually. As a matter of fact, the use of winter legumes, except bur clover on fenced pastures, was introduced less than 2 years ago, because it was feared that on unfenced fields livestock running at large in winter would make the practice impossible. However, to our surprise, the neighbors cooperated in keeping their livestock off the land, and we kept our own in pastures.

During the spring we turned under some 200 acres of about as fine vetch

(*Turn to page* 33)

Looking down from the top of the water tank on the small and simply constructed residence. Note the porch built around the hickory tree, the flowers and shrubbery in the yard.

Tomatoes & Cucumbers Reveal Diet Needs

By I. C. Hoffman

Ohio Agricultural Experiment Station, Wooster, Ohio

IN GREENHOUSES where the environmental conditions are maintained at such favorable levels for rapid plant growth, large quantities of commercial fertilizers need to be always available. Tomatoes and cucumbers are luxury consumers of mineral nutrients. They absorb considerably more of them than they can use immediately for growth, and the uncombined portions may be found within the plant. Certain portions of these unused mineral nutrients are removed from the plant when undesired parts are pruned off and when fruits are removed during the harvesting period. These are lost to the plant and speed the time when supplementary applications must be applied as growth and fruiting continue.

Certain mineral nutrients are fixed in plant tissue and then cannot be removed easily to other growth centers. Some other nutrients are held very loosely in combination and may be translocated to growing parts and be reused again and again. Under greenhouse conditions soils that are not kept well supplied with readily available minerals of all kinds very soon lose their capacity to supply them fast enough to support such rapid growth. In fact, greenhouse soils that appear to have a generous supply when the plants are transplanted may lose their reserves of certain nutrients long before the crop is completely grown. From either soil condition the first nutrients to produce external starvation symptoms are those which are fixed by the plant tissue and become practically immobile. A typical example is the case of nitrogen.

Nitrogen is fixed by the plants and very little of it is reused. In fact, it is released so slowly that the growing portions show the characteristic starvation symptoms long before they occur in the older tissues. When nitrogen salts, as nitrate of soda, nitrate of calcium, sulfate of ammonia, etc., are applied to the soil around the starving plants, the symptoms of the deficiency quickly disappear and the plants resume rapid growth. Such plants will continue to grow rapidly until they are limited by some other element which, in the meantime, has become nearly exhausted. In most cases the next mineral nutrient of importance to limit the growth of greenhouse tomatoes and cucumbers is potash. Potash is one of those elements which is loosely combined in plant tissue and may readily be transported from older to younger tissues where it may be reused.

Need for Adequate Potash

Presumably, this may be one of the reasons for the delay in the appearance of potash deficiency symptoms until after the nitrogen deficit has been relieved. In the case of tomatoes, however, apparent potash starvation symptoms do not always show first at the bases of the plants, as commonly reported, but they may occur in the upper one-half to two-thirds of the plants if there is a heavy load of rapidly growing fruits on the bottom clusters. The effect of the

fruits seems to be to absorb so large a proportion of the potash supply taken up by the plants that not enough of it gets to the top portions in time to prevent the development of several potash starvation symptoms. If, however, the supplementary nitrogen fertilizer also contained potash in adequate amounts, the starvation symptoms would not have appeared. Furthermore, when potash starvation symptoms have so far advanced in tomatoes that they are easily visible in the young fruits, they cannot be entirely corrected by the use of supplementary potash salts.

Healthy tomato leaf and fruit (left); potash-starved leaf and fruit (right). Note the hollow, irregularly ripened fruit from the potash-starved plant. The leaves are yellowed, with greenish-tinted veins.

When the symptoms are observed in very early stages most of the damage can be corrected in the younger growing tissues in the tops. Even the leaves and stems in the middle portions may be returned to approximately normal appearance. The fruits, however, which have begun to develop flattened sides and hollow locules usually fail to recover their quality and are not as heavy as they otherwise would be. It is necessary then to maintain the potash supply at a high level during the entire harvesting period so that quality, weight, and appearance of the fruits, especially tomatoes, may be maintained.

When nitrogen and potash salts have been applied liberally to greenhouse soils, inadequate supplies of phosphates sometimes limit growth, and the characters of the plants are modified accordingly. The first effects of the deficiency of any of the principal nutrients is to cause a decrease in the growth rates. Later the various organs are modified in a way which is characteristic for the deficient material. Chlorosis may assume rather definite patterns in the leaves and fruits. Normal colors are frequently modified or kept from being formed. Stem thickening and lengthening are also affected. Fruit development may be prevented or modified in size, shape, color, and certain internal characters. The roots are also affected, and the usual branching and lengthening habits may be greatly modified depending upon the nature of the nutrient and its use within the plant. For the purpose of this article the discussion will be confined to the starvation symp-

toms produced by insufficient nitrogen, phosphate, and potash.

Nitrogen Starvation

The plant as a whole.—Nitrogen deficiency may become acute at any stage of development. If the soil is deficient the symptoms may appear early in the seedling stage. If it is moderately well supplied with available nitrogen for early growth, the deficiency symptoms may appear later. When tomato and cucumber plants are in full production the symptoms may appear very suddenly, and if the condition is not remedied quickly much loss will result. The first symptom to attract attention is a stunting in growth which is followed by a change in color of the plant. The normal green color fades through various shades of green and yellow-green to a pale lemon yellow. The tops are affected first, and as the symptoms develop, older leaves become yellowish in turn towards the base of the plant. Plants, like the tomato, in which purple anthocyan pigments develop are often colored by them in the tops. This is particularly the case when the temperature is low and the soil cold and wet.

Leaves.—As nitrogen deficiency makes its appearance the leaves in the tops fail to grow to normal size for greenhouse conditions. They remain small and usually are smooth, thin, and flat. The color turns to a yellowish green with the destruction of the chlorophyll, and purple color develops in the veins on the under sides of the tomato leaves. Since the forcing cucumber varieties do not form anthocyans, the color which finally develops in them is a pale greenish yellow. In very extreme cases practically all of the chlorophyll is broken down, and the final color is nearly a clear yellow. In the greenhouse nitrogen starvation symptoms may be produced by surface applications of straw and strawy manures. The condition is made very acute by the decomposition of the straw. Since straw does not contain enough nitrogen to rot itself, the organisms must draw on the supply within the soil. In a short time the soil nitrogen may be locked up temporarily by the soil organisms, and the plants may suffer if the total supply of nitrogen is not sufficient to meet all needs. As the leaves collapse, the dying begins at the mid-ribs and proceeds towards the margins without forming any definite pattern.

Stems.—The stems of nitrogen deficient tomatoes and cucumbers are hard and fibrous. They are slender, whiplike, and in tomatoes considerable anthocyan develops, which produces a distinct purplish color. In severe cases the green color fades much the same as in the leaves.

Roots.—With low nitrogen supply the roots of tomato and cucumber plants are often more fully developed than the tops. With a very low supply they become stunted, and in time they will turn brown and die.

Fruits and seeds.—Fruit formation is greatly restricted when nitrogen is not available in sufficient quantities. When the temperature is high during the long days of summer and nitrogen is deficient, tomato flower buds may turn yellow and drop without opening. This latter phenomenon seems to be the result of a chain of circumstances. It appears that when nitrogen is deficient less carbohydrates are formed, since the leaf area is small and the chlorophyll greatly reduced in quantity. At that time of year the night temperatures are also high. This will tend to reduce the carbohydrate supply by maintaining a high respiration rate all of the time. Respiration quickly destroys the reserve carbohydrates, and the blossom buds absciss and drop. By the addition of supplementary nitrogen, the chain of reactions is reversed. The normal green color is built up and the leaf area increased in size. Carbohydrates are again synthesized in quantity, the new buds develop to full anthesis, and fruiting is resumed. The condition may be further improved by liberally syringing the plants and ground with water to aid in lowering the temperature. Water alone will not have this effect, but when

water and nitrogen are used together, improvement can be seen in 3 or 4 days, and recovery follows in a short time. Similar effects have been observed with cucumbers.

When nitrogen deficient conditions are not corrected, the number and size of the fruits are greatly reduced. Tomato fruits are often pale green in color while young but frequently are highly colored when ripe. They are very firm and well shaped, but small.

Cucumber fruits on nitrogen deficient plants are frequently so light in color that they must be sold with the off-grade fruits. As the effects become more pronounced, the cucumbers become pointed at the blossom end as well as light in color. Nitrogen deficiency is one of the main causes of low greenhouse yields, and under extreme conditions the mature seeds are light in weight.

Phosphorus Starvation

The plant as a whole.—The plants tend to grow slowly and mature late. Tomato and cucumber plants in phosphate deficient soil have become as tall in the greenhouse as those in well-fertilized soil, but the yields have not been as great, and ripening has usually been delayed. In the early stages the plants may be very dark green for a time, and then tomato plants may develop much dark purple color. This may be in part a seasonal effect, for it is usually confined to early spring. Later, as the daily temperatures increase and as the plants become older, the anythocyans largely disappear. Sometimes the color of the plant appears dull green when it reaches maturity.

Leaves and stems.—In the early stages of growth the color may become much darker green for a time than in well-fertilized plants. Tomato leaves develop much purple pigment during the short days when the temperature is low and soil moisture relatively high. The stems of phosphate deficient plants are frequently more slender and fibrous than well-fertilized ones. Tomato stems are often colored while young the same as the leaves.

Roots.—Phosphorus deficiency inhibits

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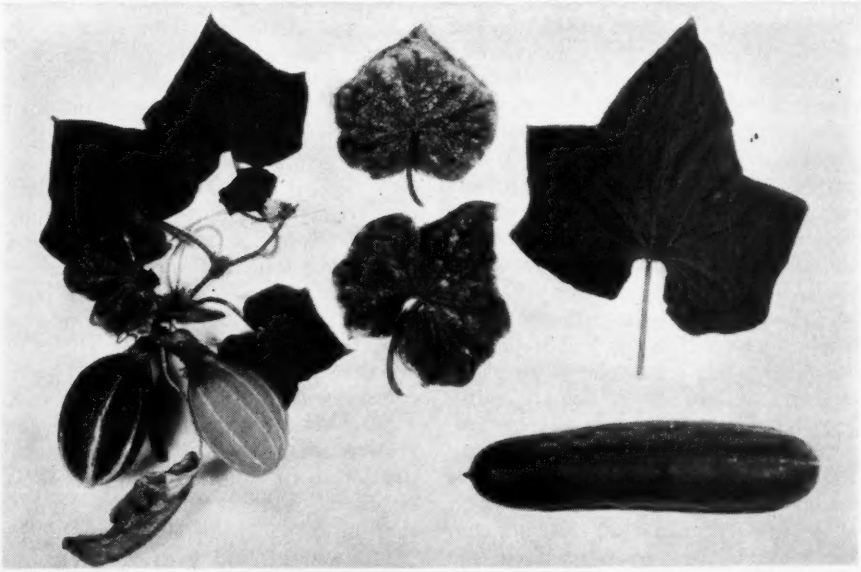
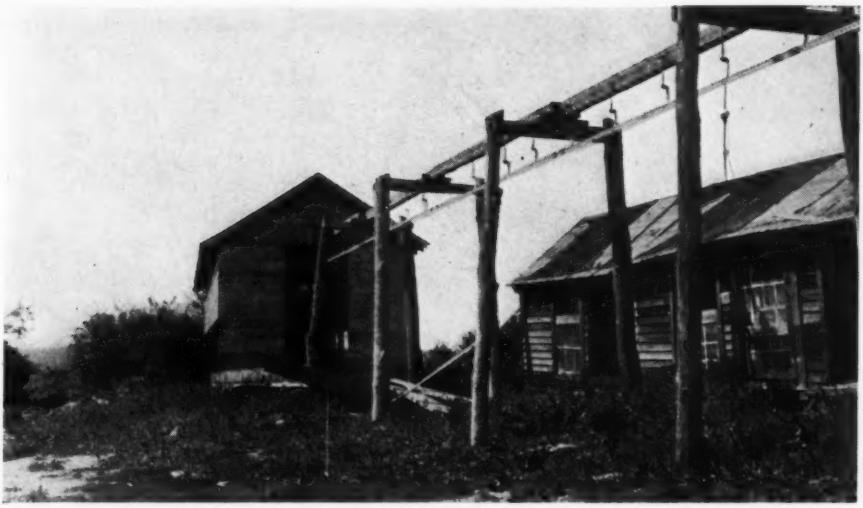


Potash-starved leaves and fruits of cucumber (left) compared with healthy ones (right). Note chlorotic leaves and fruits with constricted necks due to lack of potash.



A simple and inexpensive manure shed with a concrete wall and floor prevents leaching and, if the manure is superphosphated, will preserve its value until it is spread.

Our Responsibility With Manure

By Ford S. Prince

Agronomist, Agricultural Experiment Station, Durham, New Hampshire

THUS far in the Agricultural Conservation Program, the huge losses that occur to manure on the farms of the country have not been specifically recognized to the extent that practices have been formulated to prevent the tremendous draft on fertility that these losses entail.

It is probably fair to state that over half the fertilizing value of manure is lost during the period that elapses between its production and its incorporation with the soil. Under ideal conditions some loss of nitrogen is bound to occur through the escape of ammonia in gaseous form. Unless sufficient bedding is used to absorb the urine this portion may escape, with a consequent loss of both nitrogen and potash. Exposure to rain causes manure to suffer much loss by leaching, and this loss affects the more soluble plant food and hence the most valuable portion. Drying permits nitrogen to escape; freezing withdraws water from the mass and results in serious nitrogen losses; and even after spreading, if the manure is not immediately incorporated with the soil, nitrogen is dissipated by being volatilized and carried off as a gas in the atmosphere. Fermentation, lack of compaction, and exposure of the surface of manure heaps to the air or weather are aggravating and contribut-

Manure loses half its value in a few months exposed, as it is here, to the weather. Additional water from the eaves of the barn hastens the leaching.

ing factors promoting losses. From the time manure is voided until it is intimately incorporated with the soil, it is subject to loss. Much of this loss is preventable by proper conservation methods.

It is not advisable to close our eyes or become too complacent about this very real opportunity to save fertility elements. The nitrogen that escapes into the air from manure is just as valuable as that which we purchase in the fertilizer bag. Potash, the greater portion of which is contained in the urine, is in solution and is as available to plants as potassic fertilizers. Phosphoric acid in organic form is probably more valuable than its equivalent in superphosphates, although this element is not subject to such major losses as nitrogen and potash. Besides these three important elements, manure carries all the minor ones that have entered into the nutrition of the feed stuffs eaten by the livestock. While there is little data available on these elements as manure components, it is quite possible that the more soluble of these are adversely affected by faulty handling of the manure.

Waste Is Poor Business

It appears to be poor business to allow this waste to occur, especially that which can be easily prevented, and then later take funds to buy the equivalent of the losses in commercial fertilizers.

No method of procedure has yet been devised to save all the fertility elements voided by livestock. To do so would involve catching all the excrement and harrowing it into the soil at once. This would keep several men busy day and night in the average dairy barn, and with team or tractor in the field. The reason for such haste lies in the fact that urea nitrogen changes to ammonium carbonate rather quickly in the presence of air, and in this unstable compound the ammonia readily escapes into the air as a gas. The warmer the temperature the more quickly this transformation occurs. Under conditions such as are found in the average dairy barn this occurs probably in from 24 to 48 hours. Losses therefore are simultaneous with the change, and the losses are commensurate with its rapidity in unprotected manure.

The Function of Bedding

Any substance that will absorb and hold gases, or a chemical material which will react with the ammonia and change it into a stable compound, renders manure less vulnerable to immediate loss. Adequate bedding to absorb the liquid will also catch some of the ammonia because of its porous nature. Of all the chemical substances that have been experimented with up to the moment to react with ammonia, superphosphate of a 16% or 20% composition has proved most satisfactory and effective. The net result of the use of this substance is to change volatile ammonium carbonate into non-volatile ammonium sulphate, a substance which is still subject to leaching but which will not escape in a gaseous condition.

True and effective conservation of manure involves the use of both these substances in amounts sufficient to ade-

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Uncle Henry McDaniel Beats Tomato Record

A 5-year rivalry between Henry McDaniel, 78, and Charles Neeves, 76, both retired Boone County farmers and neighbors, as to who was the best tomato grower, reached a climax at the closing banquet of the eleventh annual conference of Indiana canners, fieldmen and medal winners, held recently at Purdue University. Roscoe Fraser, Purdue Extension Horticulturist, announced McDaniel as State champion and Neeves as reserve State champion of the "Indiana U. S. 'Won' Club" and extension project contest on growing quality tomatoes sponsored by Purdue, county agricultural agents, Indiana Canners' Association, local canning companies, and growers.

Champion McDaniel, who enjoys rivalry and believes a man never gets too old to learn new ideas, produced the all-time record yield of 26.02 tons of tomatoes per acre; while the runner-up, Neighbor Neeves, grew tomatoes at the rate of 21.9 tons per acre. The previous high record in the project was 15.18 tons per acre in 1935. The champion's tomatoes graded 87.9 per cent No. 1's and 12.1 per cent No. 2's, there being no culls.

Not liking the idea of sitting down when he is capable of doing a constructive and interesting piece of work, Champ. McDaniel, who wants to be known as Uncle Henry, decided that "no young whippersnapper like 76-year-old Neeves" could beat him growing quality tomatoes. He selected a piece of ground that had been a permanent pasture and a commercial sheep feeding lot for many years. It was in corn during the 1936 season. The lot was plowed on May 10, double-disced two times, harrowed once, and planted with certified Baltimore tomato plants on May 18. The fertilizer, which was applied at the rate of 250 pounds per

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Henry McDaniel (right), State champion of the Indiana U. S. "Won" Club, talks over the recent contest with his rival and runner-up, Charles Neeves.

Red Raspberries Need Complete Fertilizers

By W. J. Strong
Horticultural Experiment Station, Vineland Station, Ontario, Canada

EXPERIMENTAL results with fertilizers on the red raspberry have been rather variable, and fertilizer practices amongst growers have been anything but uniform. The value of comparatively large amounts of organic matter is usually stressed, due, no doubt, as much to experience and observation amongst growers as to experimental evidence.

The role of organic matter in soils cannot be discussed here in detail, but it is advisable perhaps to remind the reader that in addition to the various chemical and biological changes which it brings about in the soil, it also produces marked physical effects. It acts as a binding medium in the lighter soils and makes them more retentive of moisture, so that larger quantities may be held in reserve. Also, it helps to open up heavier soils, which improves their water-holding capacity and makes possible better air circulation, so that roots may penetrate to a greater depth. These functions are of particular value for the red raspberry which is apt to suffer severely from drought during the growing and ripening season.

It has been demonstrated by various experiments that large, vigorous canes yield more and larger fruit than small, weak ones. Growth is usually increased by nitrogen, hence the crop also may be increased by its use. Under some conditions however, growth may be retarded or actual injury occur, if large amounts of nitrogen are applied in a readily available form, such as nitrate of soda.

While the need for organic matter and nitrogen appears to be well established, there is very little information as to the basic mineral requirements of this fruit. It is not definitely known whether the red raspberry requires relatively small or large amounts of any or all of the principal minerals for its best development. Work in England [1] with various fruits, including the red raspberry, indicates that if one or more of the principal minerals, phosphorus, potassium, calcium, magnesium, etc., are left out of sand culture experiments, certain foliage symptoms may appear. Some of these symptoms may show up under field conditions and can be corrected by applying the appropriate minerals in sufficient quantities. Reduced yields, however, may result before definite deficiency symptoms appear.

Most of the earlier field experiments with mineral fertilizers on the red raspberry have given indefinite results, so that the value of extra minerals has often been questioned. Lack of response to applications of minerals may be due to two causes. First, where the soil is naturally well supplied with minerals and the organic matter is kept up, the minerals become available to the plants in sufficient quantities for their best development. Second, the soil may have the capacity to act chemically on the mineral fertilizer applied, changing much of it into a form unavailable to the plant. This is par-

[1] Wallace, T. Experiments in Manuring Fruit Trees, Journal of Pomology and Hort. Science, Vol. V, 1927.

ticularly true with phosphorus and potassium, especially if they are left at or near the surface for a time. There is less danger of this change taking place if the minerals are plowed under immediately after sowing.

Some Clear-cut Results

Several more recent field experiments carried on in England,[2] the United States,[3 and 4] and Canada[5] have given rather clear-cut results.

[2] Hoblyn, T. N. The Layout and Conduct of Two Manurial Trials on Raspberries. Jour. of Pom. & Hort. Sci., Vol. IX, 1931, p. 328.

[3] Stene, A. E. The Fertilization of Red Raspberries, Rhode Island Exp. Station, Bulletin 229, 1931.

[4] ———— Preliminary Studies in the Fertilization of Red Raspberries, Proc. Amer. Soc. for Hort. Sci., Vol. 30, 1933.

[5] Strong, W. J. Results with Fertilizers on the Red Raspberry, Sci. Agric. 16:8, April 1936.

Normal raspberry foliage on the left. Foliage showing potassium deficiency on the right. Note particularly the upward and inward curling of the leaf margins, which assume a distinct gray color.

The experiment in England, under the supervision of Mr. T. N. Hoblyn at East Malling, was conducted in a very thorough manner. Two English varieties, Pyne's Royal and Lloyd George, with 4 acres and 3½ acres respectively were used. The former was divided into 96 plots, which allowed for 12 fertilizer treatments with 8 replications of each. The latter was divided into 80 plots with 10 fertilizer treatments of 8 replications. The plots were arranged in randomized blocks, so that the results could be analyzed statistically by methods originally devised by R. A. Fisher of The Rothamsted Experiment Station. The fertilizers used included sulphate of ammonia, sulphate of potash, kainit (a potassium chloride fertilizer), and shoddy (an organic fertilizer supplying 16% ammonia).

The details of this experiment are not included here, but the outstanding results are summed up in a quotation from the original report of the experiment.[2]

"The most important manurial information, which has been obtained from these experiments with very different varieties, is the necessity on this soil for a proper balance between nitrogen and potash. Applications of nitrogen, up to a point, may produce more cane, but if this is overdone, the cane growth may be reduced. For crop, however, nitrogen alone has been not only ineffective but inadvisable except in the presence of potash, which, where applied as the sulphate, has always proved beneficial in the quantities applied;" also, "it appears

that kainit is, on the whole, less suitable than sulphate of potash, for though in a single season it may prove beneficial, in others it may do harm."

The work in the U. S. A.[3 and 4] was carried on at the Rhode Island Experiment Station as two separate experiments, on two types of soil. The first consisted of one plot of each of the following treatments: Phosphorus plus potassium, nitrogen plus potassium, nitrogen plus phosphorus, and nitrogen plus phosphorus plus potassium, but no check plot. These were given for 3 years in succession at the rate of 500 pounds per acre for the complete fertilizer, a 4-10-6 mixture made up of nitrate of soda, sulphate of ammonia, superphosphate, and muriate of potash. Each plot was 24 by 69.57 feet; there were no buffer or guard rows to separate treatments.

The results of this experiment are best stated by the following paragraph from the summary in Rhode Island Bulletin 229. "The best yield of red raspberries has been secured from a fertilizer containing all three elements, nitrogen, phosphoric acid, and potash. Leaving potash out of the fertilizer reduced the total yield for three seasons to less than one-half of that harvested from the plot receiving a 'complete' fertilizer. Leaving out nitrogen reduced the yield about 30 per cent and omitting phosphoric acid about 20 per cent, from the yield obtained with a complete fertilizer."

The second experiment consisted of the same treatments but in three quantities, i. e., 500, 1,000, and 1,500 pounds of the 4-10-6 mixture per acre on the complete fertilizer plots. Check plots were provided, but no buffer rows. There were four replications of each treatment arranged somewhat at random. Yields follow very closely those obtained in the first experiment. The larger applications, however, gave slightly decreased yields rather than further increases.

Comparative results from both these experiments are summarized in table I and are shown as percentages, 100 representing the yield from complete fertilizer.

TABLE I.—RESULTS OF FERTILIZER EXPERIMENTS WITH RED RASPBERRIES AT THE RHODE ISLAND EXPERIMENT STATION

Fertilizer Treatment		First Experiment	Second Experiment
Complete Fertilizer	(NPK)	100	100
Check Plots	(O)	...	37
No Potash	(NP)	47	53
No Nitrogen	(PK)	70	69
No Phosphorus	(NK)	82	84

The Canadian Experiment [5] was conducted by the writer at the Horticultural Experiment Station, Vineland, in the tender fruit section of the Niagara Peninsula.

The soil is Vineland fine sandy loam from 4 to 10 inches deep with a pH value of about 6.5 and is fairly well supplied with organic matter. The subsoil (underlaid with clay at varying depth from 3 ft. 6 ins. to 7 ft. 6 ins.) is a very fine sand interspersed with lenses, of varying size and thickness, of a clay and sand mixture. Soil of this type is used extensively for growing peaches, small fruits, and vegetable crops.

Chemical tests showed that the soil was fairly well supplied with readily available phosphorus, 70 to 75 parts

[3] Stene, A. E. The Fertilization of Red Raspberries, Rhode Island Exp. Station, Bulletin 229, 1931.

[4] ———— Preliminary Studies in the Fertilization of Red Raspberries, Proc. Amer. Soc. for Hort. Sci., Vol. 30, 1933.

[5] Strong, W. J. Results with Fertilizers on the Red Raspberry, Sci. Agric. 16:8, April 1936.

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PICTORIAL

GETTING PREPARED FOR SUMMER.

Above: **Spring comes to the backroads.**
Below: **Fancies often delay spring work.**

Above: **Distance doesn't count when they're biting.**
Below: **One reason for that tired "May feeling."**

Left: **May adds beauty to commonplace landscapes.**

Below: **The Hood River Valley is always beautiful.**

© Oregon State Highway Department.

The Editors Talk

From Fibre to Feeds

Southern agriculture is changing from fibre to feeds; less cotton and more wheat, hay, legumes, peanuts, and other crops. In 14 Southern States the acreage of cotton has been reduced from 39,706,000 acres in 1933 to 28,000,000 under the Cotton Act of 1938 or a reduction in acreage of 11,706,000 acres in 5 years. In sharp contrast, according to figures of the U. S. Department of Agriculture, the planted acreage of wheat increased by 4,505,000 acres from 1933 to 1937. Hay increased by 3,061,000 acres, and cowpeas by 2,029,000 acres during the same period. The acreage of tobacco was reduced by 53,200 acres, and the acreage of corn has remained approximately the same from 1933 to 1937.

One of the important problems facing the farmers and farm advisers in the South today is what to do with the acreage formerly in cotton. Current changes mean agricultural reorganization on a major scale. A greater crop diversification is inevitable. These changes have an important bearing on fertilizer use and consumption. The day when most of the fertilizer was applied to cotton, tobacco, and a little to corn is gone, and the use of fertilizers must now be studied from a broader viewpoint. The Southern Agricultural Workers are only too well aware of these problems and are working faithfully to keep abreast of the times and to advise the farmer in his best interest what to do and how to do it.

Under these changing conditions, what are some of the fertilizer problems? Even though reduced in acreage, cotton is still, of course, the most important cash and fertilizer crop. The problem is to produce the most profitable yields at the lowest cost of production on the acres allotted to cotton. Thus finding the most profitable amount of fertilizer per acre and making it possible for the farmer to use this amount of fertilizer are of first importance. In close conjunction is the analysis used and the elimination of expensive, low analysis goods. The trend is decidedly toward higher and more profitable fertilizer analyses.

In reducing the cost of production and the determination of the most profitable fertilizer analysis, more attention is being paid to short chemical methods of testing soils. The necessity for calibrating such methods to meet the needs of Southern soils and cropping conditions is fully recognized.

The best fertilizer treatment for the crops taking the place of cotton, such as hay, pastures, and legumes, is a problem of recognized importance. With an increase of approximately 5,000,000 acres of hay and cowpeas in 4 years, the need for knowing the best fertilizer treatment and methods of maintaining soil fertility is apparent. Peanuts is another crop receiving increasing attention from the point of view of its fertilizer requirement. Soil deficiencies of the so-called secondary elements, such as magnesium, boron, and manganese, affect the returns obtained from the older fertilizer elements, nitrogen, phosphorus, and potash. The availability of these secondary elements under Southern soil conditions, the amounts to be applied, and when they are to be applied are all important questions receiving

consideration, especially in certain more eastern territories where deficiencies in these elements occur.

The effect of certain crops on the crop that follows is another practical question facing many farmers. It has been noted, for instance, that when cotton follows a crop of legumes turned under the cotton then exhibits nutrient deficiency symptoms. What is the cause and what is the remedy? As the acreage in peanuts increases, the effect of peanuts on the crop that follows is another consideration of some importance.

These changes in Southern agriculture affect the fertilizer man as well as the farmer and farm adviser. There is a greater need today for closer cooperation between the fertilizer industry and agronomists in solving the practical fertilizer problems facing the farmer and making the best fertilizer programs known. In spite of the reduction in acreage of the chief fertilizer crop, cotton, with such cooperation and the proper use of fertilizers the outlook for their increased use in Southern agriculture is brighter than it ever was.

Behind the Figures

It is customary for us to accept facts and figures with little questioning or thought of the amount of work involved in obtaining the results. An example—how much is generally known of the well-organized Government Crop Reporting Service which provides the statistical information upon which agricultural programs and the programs of many allied industries are formulated?

The point was brought to mind by a press release of the U. S. Department of Agriculture to the effect that the Crop Board was celebrating its 75th anniversary during the week of May 9-14. For the occasion, a group of veteran reporters had been invited to Washington by Secretary Wallace.

According to the release, the first crop report—issued in May 1863 by Isaac Newton, first Commissioner of Agriculture, appointed by President Lincoln in 1862—was compiled on the basis of returns from less than 2,000 farmers in 21 States. Today there are more than 200,000 voluntary reporters submitting crop and livestock schedules regularly to the Department of Agriculture. More than 2,000 women reporters—some in the service for more than 15 years—are on the rolls.

Many changes have been made in crop reporting and statistical methods since the early days when the telegraph was not yet in universal use, the telephone was unknown, and the mails to many rural places were carried by stage-coach and pony express. In those days, little was known of the acreage and condition of growing crops. Prices gyrated on false rumors of crop damage.

Now the statisticians speed the State totals and estimates to Washington where once or twice a month the Crop Reporting Board meets in locked chambers with sealed blinds, shadowproof windows, and disconnected telephone and telegraph instruments. Guards stand at the doors. Newspaper and commodity exchange reporters wait nearby to flash all over the world by radio, telegraph, telephone, and news bulletins the reports of the Board.

It would be difficult to estimate the importance of the service headed in the Crop Reporting Board. To the more than 200,000 volunteer reporters, our apologies for thoughtlessness of your great contribution to the betterment of our agriculture. The Service deserves heartiest congratulations on its 75th anniversary.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture and the State Experiment Stations relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

¶ Before any marked advancement in obtaining the greatest efficiency from fertilizers can be accomplished from crops grown in the Southeast, a revolutionary improvement in method of applying the fertilizer is necessary. By way of attaining this goal, fertilizer placement projects have been under study for some time at locations where full cooperation of the National Joint Committee on Fertilizer Application and agricultural specialists of the U. S. Department of Agriculture has been given the State experiment stations.

Two new publications from North and South Carolina report essential facts on this phase of fertilizer application, based on the extensive placement investigations conducted on cotton and tobacco in the respective States. These are: North Carolina Agricultural Experiment Station Bulletin 318, "Placement of Fertilizer for Cotton," by E. R. Collins and H. B. Mann of the Agronomy Department, and G. A. Cummings, Bureau of Agricultural Engineering, U. S. Department of Agriculture; and Clemson College (South Carolina) Agricultural Educational Bulletin 14, numbers 5 and 6, "Fertilizer Placement Studies with Cotton and Tobacco," by W. G. Crandall, et al.

The data obtained from these investigations clearly emphasize the advantage of side placement of the fertilizer so it does not come in direct contact with the seed or root zone. Applying the fertilizer in narrow bands 2.5 inches to each side of the row and 2 or 3 inches below the seed or root crown level generally gave the best results. Under some conditions, however, equally good results were observed when the fertilizer was placed on only one side of the row, especially on the heavier soils typical of the Piedmont area.

The usual method of placing the fertilizer under the seed or mixing it with the soil before planting often caused delayed germination and reduced stands, while the side placement not only resulted in earlier germination and better stands, but earlier maturity and higher yields, particularly under less favorable moisture conditions. Yield differences were more pronounced when higher rates of standard or double-strength fertilizers were employed.

The above contributions add greatly to the limited literature available on this important subject, and doubtless will be a material aid in solving a major problem for cotton and tobacco growers.

"Summary of Outlying Fertilizer Experiments, 1936-37," Agr. Exp. Sta., Fayetteville, Ark., Dan T. Gray, Director.

"Commercial Fertilizers for General Field Crops," Agr. Ext. Serv., Columbia, Mo., Cir. 315, Nov. 1934, M. F. Miller.

"Sources of Fertilizer Materials," Agr. Exp. Sta., Raleigh, N. C., Cir. 109, Jan. 1938, J. F. Lutz.

"Liming and Fertilizer Recommendations for Bright Flue-cured Tobacco Land, 1938," Agr. Ext. Serv., Clemson, S. C.

"Fertilizer Formulas for Tobacco 1938," Agr. Ext. Serv., Clemson, S. C.

"Effect of Fertilizers on Composition of Soybean Hay and Seed and of Crop Management on Carbon, Nitrogen, and Reaction of Norfolk Sand," U. S. D. A., Washington, D. C., Tech. Bul. 586, Dec. 1937, J. E. Adams, H. M. Boggs, and E. M. Roller.

Soils

¶ Kentucky Extension Circular 304 entitled "Soil Erosion and Its Control," by George Roberts, E. G. Welch, and J. B. Kelley, details the important farming practices which help to control erosion. According to the authors, the usefulness of land for future generations is being unduly impaired by erosion and by the filling of stream channels, causing them to overflow and injure bottom lands and other farm property. Water erosion is the greatest single cause of fertility loss from Kentucky soils, and since practically the entire area of the State is more or less rolling, few farmers are exempt from the ravishing effects of erosion. All farmers in this great agricultural State should take it upon themselves to adopt the control measures exemplified in this circular. A definite warning is manifested by the authors in declaring that "if erosion continues at its present rate, soon only a part of it (Kentucky) will satisfy rural life, and that part will have a severe drain placed upon it in the form of taxes to maintain government, institutions, and roads for the State."

"Conserving Soil with Natural Grass Waterways," Agr. Ext. Serv., Columbia, Mo., Cir. 362, April 1937, W. R. Tascher and Marion W. Clark.

"Irrigation Development in Montana, Part 1. Water Supply," Agr. Exp. Sta., Bozeman, Mont., Bul. 353, Jan. 1938, O. W. Monson, Clyde McKee, and P. L. Slagsvold.

"Farming With and Without Lime," Agr. Ext. Serv., Columbus, Ohio, D. R. Dodd.

"What Is Soil Erosion," U. S. D. A., Washington, D. C., Misc. Pub. 286, Feb. 1938, C. F. Stewart Sharpe.

"The Border Method of Irrigation," U. S. D. A., Washington, D. C., Farmers' Bul. 1243, Revised Oct. 1937, Samuel Fortier.

"Chemical and Physical Studies of Certain Hawaiian Soil Profiles," U. S. D. A., Washington, D. C., Tech. Bul. 584, Dec. 1937, George J. Hough and Horace G. Byers.

Crops

¶ "Asparagus Culture," U. S. Department of Agriculture Farmers' Bulletin 1646, by Ross C. Thompson, is a revised edition of Farmers' Bulletin 829. Like the earlier publication, the new bulletin devotes considerable attention to the soil and fertility requirements of the crop, suitable varieties, growing and handling the crowns, cultivation and care, and preparation for market. Asparagus can be grown under a wide range of soil and climatic conditions, but is not particularly adapted to some sections in the South where the warmer winter climate does not check the growth and give the plant a dormant period. Vigorous 1-year-old crowns produce the heaviest yielding plantations, and crowns more than 2 years old should not be used for planting, the author advises. In localities where asparagus rust is prevalent, only varieties resistant to the disease should be used for starting a new set.

The best types of soil for permanent plants are deep, loose, and light sandy loams. It is essential that the soil be one that affords good drainage. Muck and light sandy loams well supplied with organic matter are ideal for asparagus. Soils ranging from slightly acid to slightly alkaline are best. The matter of fertilizer practice is a local problem and must be determined by local conditions. In the eastern part of the country an application of 1,000 to 1,500 pounds of a complete fertilizer containing 4 to 5% nitrogen, 8 to 10% phosphoric acid, and 6 to 10% potash usually proves profitable, in addition to manure. The author suggests that the fertilizer either be broadcast and thoroughly mixed into the soil if applied before the plants are set, or be delayed until after setting the plants and applied along the rows and worked into the soil by cultivation. Since the crop usually lasts for 8 to 20 years, if well cared for, fertility maintenance is an important factor to successful production. Cultivation should begin soon after the crowns are planted and continue throughout the season to keep down weeds.

The Palmetto, Reading, Giant, Argenteuil, Mary Washington, and Martha Washington are among the desirable varieties. The Washington strains are of high commercial quality, in addition to being rust-resistant.

"Chemical Investigations of the Tobacco Plant. VII. Chemical Changes That Occur in Stalks During Culture in Light and in Darkness," Agr. Exp. Sta., New Haven, Conn., Bul. 407, Feb. 1938, Hubert Bradford Vickery, George W. Pucher, Alfred J. Wakeman, and Charles S. Leavenworth.

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"Report of Progress for Year Ending June 30, 1937," Agr. Exp. Sta., Orono, Maine, Bul. 387, June 1937.

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"Sweet Sorghum (Cane, Sorgo) for Silage and Forage," Agr. Ext. Serv., Columbia, Mo., Cir. 380, Mar. 1938, C. A. Helm.

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"Growing Tomatoes for Market," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Bul. 377, Oct. 1937, G. J. Raleigh.

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"Inoculation for Legumes," Agr. Exp. Sta., Geneva, N. Y., Cir. 179, Mar. 1, 1938, A. W. Hofer and J. K. Wilson.

"Establishing a Commercial Peach Orchard," Agr. Ext. Serv., Raleigh, N. C., Cir. 220, Mar. 1938, H. R. Niswonger and L. P. Watson.

"Ohio Trees," Agr. Ext. Serv., Columbus, Ohio, Bul. 185, F. W. Dean.

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"Forty-seventh Annual Report of the University of Wyoming Agricultural Experiment Station, 1936-1937," Agr. Exp. Sta., Laramie, Wyo., J. A. Hill, Director.

"Two New Varieties of Sugarcane for Sirup Production," U. S. D. A., Washington, D. C., Cir. 461, Nov. 1937, B. A. Belcher and S. F. Sherwood.

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"Factors Affecting the Rate of Drying of Kieffer Pears," U. S. D. A., Washington, D. C., Tech. Bul. 592, Dec. 1937, C. W. Culpepper and H. H. Moon.

Economics

¶ A good illustration of the growth of the fertilizer industry on the western edge of the fertilizer belt may be found in Wisconsin Fertilizer Statistics 1937 published as Bulletin No. 190 of the Wisconsin Department of Agriculture and Markets, under the direction of W. B. Griem. Fertilizer consumption, which was only 1,500 tons in 1909, reached a peak of 51,222 tons in 1930; receded to 16,311 tons in 1933; and advanced again to 42,872 tons in 1937. The 1937 tonnage is greater by 33%

than 1936 and is larger than in any year previous to 1930. The most important single analysis from the tonnage standpoint was 2-12-6 with 9,650 tons, followed by 3-12-12 with 5,289 tons. The total plant-food content of all fertilizers, which was 20.11% in 1928, increased to 23.8% in 1937. This is the largest average plant-food content for Wisconsin fertilizers with the exception of 1930, when it was estimated to be 24.45%. The increase which has taken place in plant-food content is largely attributed to the higher nitrogen and potash content of all fertilizers. In 1928 the average analysis was about 1.92% nitrogen, 12.71% phosphoric acid, and 5.48% potash. In 1937 the average analysis was 2.54% nitrogen, 12.41% phosphoric acid, and 8.85% potash. In other words, there has been approximately a 32% increase in nitrogen, and a 61% increase in potash with practically no change in phosphoric acid since 1928.

A noticeable change has occurred in the relative importance of the various fertilizers since 1928. The most important single complete fertilizer in 1928 was 2-12-2 which represented 29% of the total, 2-12-6 was second in that year with 13%, and 3-12-12 was third with 5%. In 1937 2-12-2 had dropped to 9% of the total, 2-12-6 had increased to 36%, and 3-12-12 had increased to 20%. The 3-9-18 which was only 1% in 1928 had increased to 11% in 1937. The five leading analyses represented 51% of the total in 1928 and in 1937 they represented 83%.

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"Eighth Annual Report of the New Mexico Feed and Fertilizer Control Office, Year Ending December 13, 1937, Commercial Fertilizer," N. Mex. Feed and Fer. Control Office, State College, N. Mex. Feb. 15, 1938, R. W. Ludwick and Lewis T. Elliott.

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Advantages of Living on Your Own Farm

(*From page* 12)

as ever grew and will allow almost as many acres planted last fall to bur clover to reseed and give a more perfect stand another year. The seed necessary for planting this bur clover was saved 200 miles away from this farm, for the trouble of sweeping from other land in which the family is interested, and at a cost of 3¢ per bushel for labor and less than 10 cents per bushel for sacking and delivery these many miles. Since the land on this farm was once very fertile and has deteriorated largely as a result of the waste of organic matter and nitrogen, following the continuous growing of cotton for almost a century, our hope is that the turning of these winter legumes will largely restore its original fertility, perhaps to a bale of cotton per acre rather than the one-third bale it was producing when the family moved to the place. Already, without legumes and without fertilizers, the production has been increased to more than one-half bale per acre, with that of other crops and pastures proportionately increased.

But the best part of this move to the land is in the fact that life has seemed as much worth while away from the bright lights of the town or city, and that the family, young and old, are just as well satisfied. This is best illustrated by the eagerness with which children and grandchildren living in cities from New York to Cincinnati come every year to visit on the farm where they are privileged to fish and hunt, ride horses, or to delight in watching the cows and calves, sheep and lambs, mares and colts, sows and pigs and even a few Shetland ponies provided for their pleasure.

Knowing from hearsay, which all but approaches actual experience, the joys of the Old South, one is encouraged to hope from this present experience that a return of our Southern people to the farm may largely restore a rural civilization which once was ours and was all but wiped out by a single stroke in the unwisdom of the Civil War, on whatever side may rest the responsibility. Certainly it will promote increased soil fertility and a greater diversity of crops, and with the introduction of better roads, automobiles, consolidated schools, individual lighting systems, and running water, the joys and comforts of the country home should equal or excel those of our towns and cities.

Let us at least hope that the necessity for reducing our cotton production and consequently increasing our farm income from other sources may result in a back-to-the-farm movement, because, certainly, such necessary farm diversification can never be accomplished without a more intimate contact on the part of the owner with his land.

Red Raspberries Need Complete Fertilizers

(*From page* 22)

per million, while the replaceable potassium was decidedly low, 10 or 11 parts per million. After three annual applications of fertilizers, the available phosphorus was rather more than doubled, and the replaceable potassium was almost doubled in the surface soil—first 8 inches—but there was no appreciable increase in the subsoil. Undoubtedly this soil was too low in replaceable potassium for the red raspberry, as deficiency symptoms were quite marked on the non-potash plots (figure 1).

probably potassium deficiency. From 1919 to 1923 manure was applied at the rate of 15 tons per acre, and several green manure crops were plowed under from 1924 to 1930. Just previous to planting, the ground was plowed and subsoiled to a depth of 12 to 14 inches.

The experiment was planned so that the effects of applications of nitrogen, phosphorus, and potassium both singly and in combination could be compared. There were 8 treatments with 8 replications of each, 64 plots in all, about 1/60 acre each, with buffer rows on all sides.

TABLE II—RATES PER ACRE AND DATES OF APPLYING FERTILIZERS

Fertilizers used	1932 (A)		1933 (A)		1934 (B)	
	Date	Rate lb.	Date	Rate lb.	Date	Rate lb.
Nitrate of soda (15.5%)*.....	May 19	300	May 3	600	May 15	600
Superphosphate (16%).....	May 19	750	May 4	1,200	May 2	1,200
Sulphate of potash (48.7%)...	May 20	480	May 3	480	May 2	480

(A) Fertilizers worked into ground with cultivator several days after sowing.
(B) Superphosphate and potash plowed under immediately after sowing.
* Nitrate worked in by cultivator.

Surface drainage was very fair to good. The natural underdrainage was fair but was supplemented by lines of 4-inch tile laid at 24-foot intervals. Test wells showed that the water table did not rise higher than 20 inches below the surface.

A brief history of the soil from 1918 will be of interest. In that year ground limestone was applied at the rate of 2 tons per acre. In 1920 it was in vegetable crops. From 1921 to 1927 it was used for peach trees which did not thrive on account of a "hard pan" layer and

They were arranged in eight randomized blocks, so that the results could be analyzed statistically by the Fisher method.

Fertilizers were applied in 1932, 1933, and 1934 at the rates shown in table II.

Results from the above treatments varied considerably from year to year, growth and yield in all plots being highest in 1932. Total growth and yields for 1932, 1933, and 1934 are given in table III.

TABLE III—GROWTH AND FRUIT YIELDS IN POUNDS FOR 1932, 1933, AND 1934 FOR THE 64 PLOTS. GROWTH MEASURED AS WEIGHT OF WOOD

1932		1933		1934	
Wood	Fruit	Wood	Fruit	Wood	Fruit
4,893.8	5,883.9	2,202.7	1,821.6	1,532.2	1,003.2

These yearly differences were due probably to differences in season. There

TABLE IV—RESULTS OF FERTILIZER TREATMENTS (A)

Treatments	1932		1933		1934	
	Wood	Fruit	Wood	Fruit	Wood	Fruit
Nitrate	Highly significant increase	Highly significant increase	Significant increase	No effect	Small decrease	Highly significant decrease
Phosphate	No effect	Small increase	No effect	Small increase	Almost significant increase	Almost significant increase
Potash	Slight decrease	Almost significant increase	Highly significant increase	Highly significant increase	Highly significant increase	Highly significant increase
Combinations	No apparent interaction	No apparent interaction	No apparent interaction	No apparent interaction	No apparent interaction	No apparent interaction

(A) From tables in original article (5).

also were marked differences each year in wood and yields of fruit between plots treated differently and these are briefly stated in table IV.

The results of this experiment are given also in the following summary:

1. Seasonal differences were of marked importance in these tests.
2. Nitrate of soda, 300 lb. per acre, increased yields significantly in a comparatively cool, moist season (1932), but 600 lb. per acre decreased yields in dry seasons (1933 and 1934).
3. Superphosphate, 750 lb. per acre in 1932, 1,200 lb. per acre in 1933 and 1934, gave no significant results. This particular soil was already well supplied with readily available phosphorus.
4. Sulphate of potash, 480 lb. per acre in 1932-33-34, gave significant increases in yield in 1933 and 1934. The soil was rather low in replaceable potassium.
5. In the several combinations of fertilizers the results seemed to indicate independent action rather than interaction between them.

These experiments indicate rather conclusively that under suitable conditions, applications of minerals, more particularly potassium, in some cases alone and in others with nitrogen, will result in increased growth and yield in the red raspberry.

Our Responsibility With Manure

(*From page* 18)

quately do the job for which they are designed. The function of bedding, primarily, is to absorb the liquid portion of the manure. Urine carries about one-half the nitrogen and four-fifths of the potash of the total excrement from cows. These materials are already in solution and are readily available if saved and preserved until they reach the soil. It takes 8 or 9 pounds of sawdust or straw to absorb the urine produced by an average dairy cow during a 24-hour period.

If sufficient bedding is not used, free urine escapes either before or after the manure is stored or spread. Under ordinary conditions this may occur in the barn cellar, where it runs out through openings in walls or doors unless there is a tight floor. Or it may

occur outside where the manure is piled until the farmer chooses to spread it, in which case it trickles or is squeezed out of the manure heap, resulting in a very serious loss. How serious depends entirely upon how much is lost. Since potash is so abundant in the urine, this element is lost to a greater degree than any other because of faulty methods of saving urine.

While it is commonly practiced in Europe, only a few farmers in this region have dug or constructed wells into which the urine may collect for later spreading. A short while ago I visited the farm of George Bell in Lunenburg, Vermont, who is cutting hay from stands of timothy over 50 years old. These fields are yielding 2½ tons of hay per acre. Mr. Bell has been able to achieve this by saving the liquid portion of his manure in a well and using this along with the solid portion as an annual top-dressing. He has a heavy soil, a thick stand of grass, and the top of the soil feels like a sponge when stepped on, so thoroughly is it covered with organic matter.

Phosphate Is Preservative

The use of superphosphate as a manure preservative has long been advocated by scientists and is practiced by large numbers of dairymen, although it is far from being a general practice. To be most effective, superphosphate should be spread in the gutter behind the cows after the stable is cleaned but before fresh bedding is put in. There it is, ready to perform its useful function, for it acts not only as an absorbent of the liquid itself but also reacts chemically with the nitrogen that changes into the ammonia form. The gutters should of course be tight, so that the liquid containing the superphosphate will not be lost.

The reaction that ensues when superphosphate is mixed with urine is a complex one, but it is relatively easy to understand the results that occur. Superphosphate itself is more than a phosphorous compound, for it carries gypsum as well as monocalcium phosphate. The gypsum or calcium sulphate apparently is more effective in actually holding ammonia than other compounds that may be present. Ammonium carbonate is changed by this material to ammonium sulphate, while in the process the monocalcium phosphate is reverted to the tricalcium form. At first thought this latter process might seem undesirable, but in a region of acid soils it is just the reverse, for the finely divided state of the tricalcium phosphate that is produced makes it readily available to plants, but in this form it is not water soluble and is not so easily fixed as the monocalcium form by excess aluminum and iron in acid soils that prevail in the northeast region.

Time of Spreading Important

What chance does the farmer who does not superphosphate his manure have of saving this urea nitrogen? If he spreads his manure daily and harrows it immediately, his chances are good. If he spreads daily and does not work the manure into the soil he will lose the volatile ammonia due to drying winds or freezing weather, or both, unless rain falls before this occurs. This fact has been definitely established recently by Midgley and Weiser in Vermont.

On the other hand, if this farmer chooses to store his manure instead of spreading it daily, it is still subject to loss of escaping ammonia, although the loss may be less than if it is spread at a time when it cannot be worked into the soil. Spreading manure on frozen land or in the snow, especially on a field which is subject to washing, is always questionable practice because of loss by surface washing.

As a matter of fact, there are only a comparatively few days during the year when manure can be spread without some loss by drying or due to freezing. To prevent as much loss as possible, the land should be harrowed after spreading each day if possible.

These findings by the Vermont workers mentioned limit to no small degree the use of manure for top-dressing, especially if no superphosphate has been used. They also cause us to wonder what untreated manure carries in the way of plant food as spread bv the average farmer. While manure as voided carries in the neighborhood of 10 pounds of nitrogen per ton in the liquid and solid portions, it is doubtful whether more than half of this amount ever reaches the field. Losses of potash are probably just as serious, although this element would vary more than nitrogen with the effectiveness of the methods of bedding and saving the liquid portion, since the potash is not subject to volatilization.

The Value of Manure

A ton of manure has usually been considered to be equal in plant-food value to a 100-pound bag of 10-5-10 fertilizer. With these losses in mind it is doubtful if the average ton of manure carries more than a 5-5-5 equivalent in fertilizer elements. Likewise manure has been thought low in phosphorus, but it appears that even if it has not been superphosphated, the phosphorus content is at least as high as the other two elements.

If a farmer superphosphates his manure and uses bedding enough to absorb the urine and then spreads immediately on the fields or stores where the manure is not subject to leaching, he will reduce his nitrogen losses to the point where at least 8 pounds of this element will remain in each ton of manure, in which case he would be applying the equivalent of 100 pounds of an 8-5-10 fertilizer, not counting the phosphoric acid in the superphosphate which has been used. If this has been used at the rate of 30 pounds per ton of manure (1 pound per cow per day), then his manure would carry approximately an 8-10-10 equivalent.

In view of what is now known as to the perishability of manure, it appears likely that half of its value is dissipated before it is actually worked into the soil where losses cannot further occur. If we assume that manure is worth $2 per ton and that half its value is gone before spreading, then the loss in our small State of New Hampshire reaches the enormous total of $800,000 annually. Saving one-half of this loss, or $400,000, which is easily possible, would mean rescuing the equivalent in plant-food value of the total fertilizer we purchase annually in this State! The same is true in certain measure in most of our northeastern States.

Recommended Practices

None of us who has given intensive study to the principles of the Agricultural Conservation Program believes that a farmer should get any pay for the manure that is produced on his own farm. We do believe, however, that practices designed to curb the tremendous loss that occurs to it should be developed.

The use of bedding, while vital to the preservation of manure, would be very difficult to design and administer as a practice. In many cases, however, bedding presents a very real item of cost in the dairy set-up and if under the program an orchard man can get paid for mulch carted into the orchard some provision might be made so that the dairyman could secure adequate bedding for his dairy herd.

Superphosphating cow manure is a practice that should be adopted by every dairyman. Many boards of health are requiring that lime be used in stables to keep down odors, to make them brighter, etc. Superphosphate will do everything that lime will do and in addition will preserve the nitrogen content of manure, something that lime will not do.

Since the use of superphosphate in stables preserves nitrogen and even keeps the phosphorus available to plants in the soil over a longer period, it appears that its application in this manner is more of a conservation measure than

when it is applied to the soil alone or as a component of mixed fertilizers.

To adequately recognize this in the program, superphosphate used with manure should either command a higher rate of payment or so used that it would be recognized and paid for no matter to what crop it is applied.

In the Northeast daily spreading is inadvisable, if not impossible. This means that manure must usually be stored somewhere until spread. If stored, a roof over it is a protection from severe leaching. A tight concrete floor is a protection against loss from seepage. Either one or both of these items should be recognized as important conservation measures by adequate practices in the program.

It seems logical to conclude that conservation in the broad sense should mean saving as well as adding to the fertility of our soils. The losses that occur to farm manure constitute the greatest single draft on the productiveness of the soils of the nation. While many farmers already recognize this fact and do something about it, it is doubtless true that the rank and file of dairymen will be slow to change their methods unless they are presented with a greater urge than they have received up to the present time.

Tomatoes & Cucumbers Reveal Diet Needs

(*From page* 16)

the development of the root system more than any other organ of the plant. The roots are greatly stunted, which seems to be an important factor responsible for the slow plant growth and delayed fruit development.

Fruits and seeds.—The fruits are dull in color and sometimes slight bronzing occurs before they mature. There is considerable variation in size and total weight of plant from season to season. They are, however, slow to ripen. Tomatoes on phosphate deficient plants have a "leathery" rind. The mature seeds are light in weight and germinate poorly.

Potash Starvation

The plant as a whole.—Potassium starvation may modify the growth of every organ in the plant, and the characteristic symptoms may appear at any stage of the plant's development. In soils that are extremely low in available potash, the deficiency symptoms appear in the seedling stage as soon as the supply which was in the seed has been exhausted. This is shortly after the secondary plant characters begin to form. In soils with somewhat more potash, the plants may reach the fruiting stage before the starvation symptoms begin to appear. In recent tests at the Ohio Station when muriate of potash was applied at the rate of 500 pounds an acre to a spring tomato crop, the starvation symptoms began to appear about the time the fruits began to ripen on the first cluster. On soils that are very deficient in available potash, it is the usual experience for the symptoms to appear first on the older leaves at the base of the plants. Since potash is only loosely combined in plant tissues, it is easily translocated from place to place. It is, therefore, removed from the older tissues and reused in building up the new under ordinary conditions. For this reason the young and growing parts in the tops look better than the older tissues at the base.

In the case just mentioned the starvation symptoms appeared first at the middle of the plant and affected the upper half. At that time 4 clusters had been set, and the 5th, 6th, and 7th clusters were in bloom. The blossoms were setting easily, and the fruits and plants had been growing very rapidly. The tomatoes on the first cluster were nearly all full size, and some were ripening.

Left: **A well-fertilized cucumber crop. Note the dark color and vigorous growth of the foliage and the large number of well-shaped cucumbers.** ***Right:*** **a nitrogen-starved cucumber crop. Note the light yellow foliage and scarcity of fruits. Also note the pointed cucumber at the upper left which is typical of nitrogen starvation.**

Those on the second and third were nearing maturity or growing rapidly, and the blossoms practically all set on the fourth cluster. With such a large number of fruits at the base of the plants, it seems that the demand for potash was greater than the supply, so the tops had to suffer. The condition had apparently been aggravated by two or three applications of calcium nitrate as side-dressings, which had stimulated the plants to greater growth. It is common experience that when additional nitrogen is applied to a crop where potash is limited, the increased growth hastens the appearance of potash deficiency symptoms.

Ordinarily, potash-starved plants grow slowly and may soon assume an ashen gray-green color. They are usually stunted and produce very low yields. They are also more susceptible to insect and disease attacks than normally fertilized plants.

Leaves.—Young leaves on tomato and cucumber plants starving for potassium often become finely crinkled as in crepe tissue paper, especially if much nitrogen is available. Older leaves become an ashen grayish green at first and then yellowish green along the margins, which gives the plants a dull color. The light margin finally dies and turns brown—a condition sometimes called "brown edge scorch." The injury progresses towards the center of the leaf, causing a bronzing or browning of the leaf tissue. This is followed by large, light-colored spots between the larger veins, which often become a bright orange under cool spring conditions. The development of this color proceeds rapidly from this point on, and the leaves collapse in time and die. In tomatoes and cucumbers the leaves do not drop but dry and remain attached to the plant. The petioles and veins of potash-starved leaves become very brittle and break off with light upward pressure.

Stems.—Stems of potash deficient tomato and cucumber plants become hard and woody. The cambium tissue becomes inactive and the stems fail to increase much in diameter, so they remain slender and whip-like. There is a slow increase in length, and for a time the tops look fairly normal. But by the time a few fruits ripen and are removed, growth stops in extreme cases of starvation and the top collapses and dies. Just before this stage is reached, brown streaks appear on the stems, petioles, and larger veins of the leaves of tomato plants. These spots may easily be confused with the tomato

(virus) streak disease, if the other symptoms are not carefully noted.

Roots.—Since the cambium is inactive in roots as well as in the stems of potash deficient plants, they are slender, not well developed, and often brownish in color. The roots will continue to increase in length for a time but will not increase much in diameter, since secondary thickening does not occur.

Fruits.—Potash deficiency has a decided effect on the shape, solidity, and quality of tomato and cucumber fruits. Tomato fruits on potash deficient plants become flat sided, hollow, thin walled, light in weight, and sometimes ripen unevenly. The pectic compounds do not develop around the seeds in tomato fruits. Fruits often become quite acid to the taste, color poorly, and are sometimes considerably reduced in vitamin C potency. Cucumber fruits fail to develop at the stem ends, but they do in the middles and blossom ends. This often results in gourd-shaped fruits. The flesh in the "neck" is tough and corklike and is often nearly tasteless. It is of interest to know that muskmelons on potash-starved plants are pointed at the stem end. The shape is similar to the common chestnut. White heart of watermelons is also caused by potash starvation.

Seeds.—Seeds from potash deficient plants often fail to reach maturity. They are small in size and light in weight. They are chaffy, often brown, and usually germinate poorly when they do mature.

Uncle Henry McDaniel Beats Tomato Record

(*From page* 19)

acre, was of the 2-16-8 analysis and was placed about each plant as it was set in the soil. The first picking of tomatoes was delivered to the local canning plant when it opened for the season on August 1.

McDaniel and Neeves provided the Lebanon community with plenty of interesting scenes as each would try to beat the other delivering loads of tomatoes grading 100 per cent U. S. No. 1's. It was only the inspiration given by his rival Neeves that gave him the desire to win and produce high quality tomatoes, says Champ. McDaniel.

A Balanced Fertilizer for Bright Tobacco

(*From page* 9)

The tests, results of which are given in the following three tables, were conducted at Chatham, Virginia, on typical bright-tobacco soils of the Granville type (a sandy loam surface soil with yellow sandy clay subsoil). Previous to 1936 an old field which had grown probably 20 or more tobacco crops was used, but in 1936 the experiments were all shifted to a new field. This new field had not been used for crops during a 16- or 18-year period. It was recleared of trees, and consequently the large supply of leaf mold and weeds plowed under increased the natural potash reserve above that on fields used for tobacco crops every year. The results obtained during 1936 (as table I shows), where potash was omitted or used in small quantities in the fertilizer mixture, were therefore not as low as such results usually are when old tobacco fields are used for the tests. Even the second year's results in 1937 help to support this conclusion.

TABLE 1.—VARYING NITROGEN, PHOSPHORIC ACID, AND POTASH—TOBACCO TESTS—CHATHAM 1936–1937

Plot	Fertilizer Treatment 1,000 Lbs. per Acre	1936		1937	
		Pounds per Acre	Value per Acre	Pounds per Acre	Value per Acre
1	3–8–0 (no potash)	887	$281.25	821	$176.03
2	3–8–3	914	324.55	977	236.72
3	3–8–6	1,026	306.00	1,229	333.74
4	3–8–9	950	312.85	1,155	350.64
5	3–8–16	1,106	319.80	1,248	324.88
6	3–8–20	1,040	305.65	1,194	282.86
7	3–8–30	982	255.85	1,038	205.05
8	no fertilizer	216	24.07	367	59.74
9	0–8–6 (no nitrogen)	485	124.40	864	229.89
10	2–8–6	965	301.60	1,060	274.75
11	3–8–6	1,026	306.00	1,229	333.76
12	5–8–6	900	219.70	1,132	182.93
13	3–0–6 (no phosphate)	754	146.70	599	93.31
14	3–4–6	1,000	309.60	861	210.81
15	3–8–6	1,026	306.00	1,229	333.76
16	3–12–6	1,040	329.30	1,134	313.48
17	3–16–6	1,126	340.30	1,073	310.80

NOTE: Results given above for plots 1 to 7 inclusive and plots 11 and 15 are averages of duplicate plots each year.

Formula for above fertilizer mixtures:
- Nitrogen = 1/3 Cotton Seed Meal, 1/3 Nitrate of Soda, and 1/3 Sulphate Ammonia.
- Phosphoric Acid = 16% Superphosphate.
- Potash =
  - 2% K_2O from Muriate.
  - 2% K_2O from Sul. Pot. Mag. balance from Sulphate.
  - All mixtures supplied 200 lb. per acre of Magnesium Limestone.

All potash above 6 per cent applied as a side-dressing ahead of cultivator about 20 days after transplanting.

The results shown in table I will serve to prove quite conclusively that fertilizer applications are responsible for at least 75 per cent of the yield and money value of tobacco when grown on typical bright-tobacco soil. When no fertilizer was used, the value per acre was only $24.07 for the fairly dry season of 1936 and $59.74 for the wet year, 1937, when growth was naturally boosted.

When nitrogen was omitted in the dry year, 1936, the yield and value were very low, while for the wet season, 1937, a fair crop value was obtained without added nitrogen ($229.89 per acre). All of these plots received 200 pounds of magnesium limestone per acre, which helped to boost yields where fertilizer applications were incomplete.

This field was very deficient in phosphoric acid, as can be seen from the first year's results, 1936, when the no-phosphate plot produced a value of only $146.70 per acre, which value was still lower the second year of consecutive cropping, $93.31 per acre.

In this series of 17 plots, during the first year after reclearing, the maximum money value per acre was obtained from the greatest quantity of phosphoric acid used, as a 3-16-6 (the value was $340 per acre), while during the second year of phosphate applications 8 per cent phosphoric acid, in a 3-8-6 mixture, produced the greatest money value per acre ($333.76) of any in the phosphate variation series.

On the new land it can be seen that during the first year of cropping 3 per

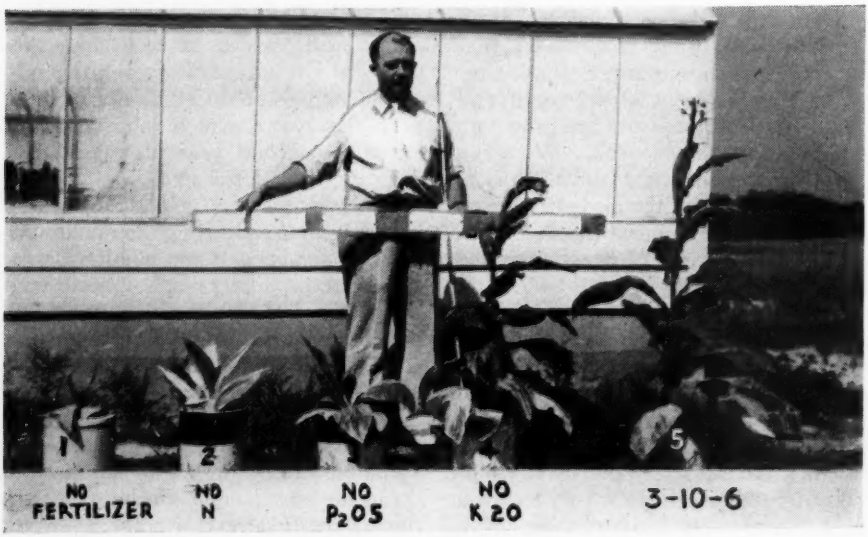
cent potash seems sufficient, and a fair crop can be produced without adding potash to the fertilizer mixture. However, by studying the results for 1937, just the second year of cropping in tobacco after clearing, some very interesting changes are most apparent. The no potash fertilizer application dropped from $281.25 per acre to $176.03 per acre, and the maximum acre value has changed from the 3-8-3 in 1936 to the 3-8-9 in 1937, showing that even the second crop of tobacco on new land requires double the quantity of potash which the first crop does.

During the first year of cropping this newly cleared land, the maximum increase from potash applications over no potash was $43.30 per acre and from only 30 pounds of K_2O per acre; while for the second year of cropping, 1937, potash applications alone showed an increased value of $174.61 per acre over no potash and was obtained from an application of 90 pounds of K_2O per acre, or 1,000 pounds per acre of 3-8-9 fertilizer. In 1937 this 3-8-9 fertilization produced $113.92 per acre greater value than the 3-8-3 did.

These results help to show why farmers have often obtained their most profitable tobacco crops when a fertilizer relatively high in phosphoric acid and fairly low in potash and nitrogen was used on new fields just cleared of trees for tobacco, while after a few years of continuous cropping the maximum values are obtained from moderate phosphoric acid applications (around 80 pounds of P_2O_5 per acre) and higher potash applications (60 to 100 pounds K_2O per acre). Many tobacco farmers complain that even with exactly the same analysis fertilizer which they used to grow crops of good quality tobacco when they first cleared their tobacco land, they now seem to grow only inferior crops on the same fields. This can better be understood when we realize that the fertilizer needs of new virgin soils and old fields are not the same.

The Disappointment Visualized

The disappointing results which a farmer might expect from using no fertilizer or from using a mixture without the necessary balance of nitrogen, phosphoric acid, and potash may be visualized by observing the growth made by six individual tobacco plants grown by the writer in greenhouse pots and illustrated in the accompanying photograph and data.



Pot No.	Fertilizer Treatment	Final Height Plants, Inches	Total Dry Matter Pounds Per Acre
1	No fertilizer	7½	106
2	0–10–6	21	169
3	3– 0–6	21	477
4	3–10–0	51	1,155
5 & 6	3–10–6	57	2,142

Above plants were transplanted March 31st and leaves were harvested July 12th and 21st.

The total dry weight was based on total weight of plants, leaf, stalk, and seed for 5,000 plants per acre (although the soil area per pot was only about 1/10 of average field area of 8 sq. ft. per plant). The soil used was the same as that in field tests for 1936, table I, and fertilized at the rate of 1,000 lb. per acre of 5,000 plants.

Table II gives the results from a few of the test plots at Chatham where various sources of materials are used to supply the necessary plant foods which make up a tobacco fertilizer. These results show why the tobacco fertilizer recommendations printed in part in this article require that one-third of the nitrogen be derived from organic materials, such as cottonseed meal, blood,

TABLE II.—SOURCES OF MATERIALS SUPPLYING NITROGEN, PHOSPHORIC ACID, AND POTASH FOR TOBACCO FERTILIZERS, 1932–1937

Plot	800 lb. 3–10–6 Per Acre	1936 Per Acre		1937 Per Acre		5-Year Average Excluding 1936 Per Acre	
		Lb.	Value	Lb.	Value	Lb.	Value
	Supplying Nitrogen						
1	Nitrate of Soda	910	$283.00	1,120	$280.00	1,145	$224.75
2	1/2 N. = Nit. Soda 1/2 N. = Sul. Ammonia	1,006	317.75	1,145	258.36	1,145	231.35
3	Urea	790	239.35	1,140	295.40	1,141	234.66
4	1/2 N. = C. S. M. 1/2 N. as Plot 2	840	274.75	1,088	304.44	1,172	254.18
5	1/4 N. genuine organics 3/4 N. as Plot 2					1,123	243.06
6	3/4 N. Ammoniated Superphosphate	805	227.46	1,036	227.68	1,064	197.35
7	0–10–6 No Nitrogen	520	111.38	566	148.38	813	150.64
	Supplying Phosphoric Acid						
8	16% Superphosphate					1,138	249.00
9	Bonemeal					1,062	216.38
10	Basic Slag					1,116	221.36
	Supplying Potash						
	Potash for above 10 Plots—1/2 Muriate, 1/2 Sul. Potash Magnesia.						
11	3–10–0 (no potash)			930	187.53		
12	Nitrate of Potash			1,073	229.99		
13	1/2 Nit. of Potash 1/2 Muriate of Potash			1,183	278.39		
14	All Muriate of Potash			903	210.01		
15	All Sulphate of Potash			969	247.10		
16	1/2 Muriate of Potash 1/2 Sulphate of Potash			1,025	251.04		
17	1/2 Muriate of Potash 1/2 Sulphate of Potash			1,179	287.96		

Nitrogen for plots 11–17 incl.—1/3 Nit. Soda 2/3 Urea.
Phosphoric acid for plots 11–16 incl.—Mono-calcium-phosphate.
Phosphoric acid for plot 17—16% Superphosphate.
All 17 plots received 200 lb. per acre Magnesium Limestone.

fish, or tankage. Such materials over a 5-year average period (when supplying from one-fourth to one-half of the total nitrogen) give values of around $250 per acre, or $20 to $25 per acre more value than the all-mineral nitrogen mixtures, such as nitrate of soda and sulphate of ammonia.

The sources which supply the necessary potash are equally as important as those supplying nitrogen. In table II (plots 12 and 13) it can be seen that while all nitrate of potash gave a value of $229.93 per acre, one-half nitrate and one-half muriate gave a value of $278.39 per acre, or an increase of nearly $50 per acre. The muriate supplied the necessary chlorine. Plots 16 and 17 show that a mixture of muriate and sulphate give greater values than either of the two sources when used alone.

an extra 100 pounds of sulphate of potash per acre (50 pounds of K_2O) increased the acre-value of tobacco from $271 to $307.80, or nearly $37 over that obtained from the 3-8-5, or 50 pounds K_2O, and an increase of $23 per acre for the 6-year average period. This same total quantity of potash, 100 pounds K_2O per acre, when applied all before transplanting in the furrow (the usual form practiced in the past) in both the 3-8-10 and the 4-8-10 mixtures gave very little increases in value over the single application of 3-8-5.

The addition of nitrogen when the original application contained 3 per cent (ammonia basis) showed increases of around $7 per acre over the 6-year average period. This 10 pounds of ammonia per acre was side-dressed just as the potash was.

TABLE III.—EXTRA SIDE-DRESSING APPLICATIONS OF NITROGEN AND POTASH

Plot	1,000 Lb. Per Acre	1937 Per Acre		6-Year Average Per Acre	
		Lb.	Value	Lb.	Value
1	3–8–5 in furrow before transplanting	1,110	$271.00	1,107	$208.35
2	2–8–10 in furrow before transplanting	1,148	278.20	1,217	211.86
3	3–8–5 in furrow before transplanting 0–0–5 (side-dressed 20 days after planting)	1,144	307.80	1,289	231.00
4	3–8–5 before planting 1–0–0 20 days after planting	1,212	301.60	1,232	215.58
5	4–8–10 in furrow	1,178	272.60	1,278	211.54
6	3–8–5 in furrow (N. as nit. soda) 1–0–5 20 days	1,228	269.60	1,317	229.75

NOTE: Above results are averages yearly of duplicate plots.
Ammonia basis used (not nitrogen).
Extra nitrogen applied was nitrate of soda and potash was sulphate.
Formula for Basal Mixture: N = 1/4 each of cottonseed meal, fish, urea, and nit. soda.
P_2O_5 = 16 per cent superphosphate.
K_2O = 2 per cent muriate, balance sul. pot. magnesia.
Also 200 pounds per acre of dolomitic limestone used.

The muriate-sulphate combination when used with superphosphate gave greater value than when used with mono-calcium-phosphate.

Table III is given here to show some of the results obtained at Chatham during the past 6 years from applying extra potash and/or extra nitrogen as a side-dressing approximately 20 days after transplanting. These results show that for 1937 (a wet year) the addition of

Based on these results and on the results of experimental tests conducted by the writer and research workers in other States, together with the experience of successful tobacco growers, agronomists and research workers who compose the tobacco research committee representing all of the bright-tobacco-producing States have made the following recommendations for the year 1938, with reference to the fertilization of

flue-cured tobacco grown on average soils:

"I. Fertilizers for Bright Flue-cured Tobacco

I. *Analyses of Mixtures and Rates of Application:*

(1) *For Heavy or More Productive Soils*—Use 3 per cent total nitrogen, 10 per cent available phosphoric acid, and 6 per cent potash. To be applied at the rates of 800 to 1,000 pounds to the acre.

(2) *For Light or Less Productive Soils*—Use 3 per cent total nitrogen, 8 per cent available phosphoric acid, and 6 per cent potash. To be applied at the rates of 800 to 1,200 pounds to the acre.

(3) *Additional Potash* — Experiments indicate that the acre value of tobacco may be materially increased by additional potash. It is therefore suggested that potash to the extent of 60 to 120 pounds of K_2O to the acre be applied in most cases as an additional side-dressing within 20 days after transplanting.

(4) *Method of Application*—Experiments indicate that fertilizers applied so as to come in direct contact with the plant roots cause loss of plants and retard early growth. It is, therefore, suggested that fertilizers be placed in bands 3 to 4 inches to the sides of the row at the approximate level of the roots, and the plants be set between these bands, or thoroughly mixed with the soil in the rows before planting.

Note 1—The above analyses may be modified, provided the given ratios are maintained and the recommended sources of plant food are used.

II. *Sources of Plant Food:*

(1) *Nitrogen*—One-third of the nitrogen should be derived from high-grade organic materials of plant or animal origin; one-third from materials supplying nitrogen in the nitrate form; and one-third from urea and/or standard inorganic sources of nitrogen. (Fertilizers that are claimed to be made according to the recommended formulas should contain not less than one-third of the total nitrogen in organic form and not less than one-fourth of the nitrogen should be water insoluble.)

(2) *Phosphoric Acid*—To be derived from any source of available phosphoric acid, provided that the available calcium in the mixture shall conform to the requirements of Subsection 7 of Section II.

(3) *Potash*—To be derived from any source of available potash, provided the chlorine content of the mixed fertilizers so compounded does not exceed 2 per cent, except that in case of soils where the pH is above 5.6 the maximum may be 3 per cent. If tobacco by-products are used as a source of potash, these must be sterilized to kill such organisms that might be present that cause diseases.

(4) *Magnesia*—It is recommended that fertilizers carry 2 per cent magnesia (MgO), at least one-half of which shall be derived from water-soluble materials, or shall be water soluble in the mixed fertilizer.

(5) *Chlorine* — Available experimental data from bright tobacco sections of Virginia, North Carolina, South Carolina, and Georgia show that a small quantity of chlorine in the tobacco fertilizer increases the acre value of the crop. Experiments have shown,

however, that an excessive amount of chlorine in fertilizers used for tobacco injures its growth and reduces quality, producing a thick, brittle leaf, which when cured becomes thin, soggy, and dull in color. It also has an unfavorable effect upon the burning quality of the cured leaf. It is recommended, therefore, that fertilizers should be compounded in such proportions that the fertilizer mixtures shall contain 2 per cent chlorine. Where the pH of the soil is above 5.6, the maximum may be 3 per cent.

(6) *Sulphur*—It is suggested that fertilizers for bright tobacco be formulated in such a manner as to reduce the more soluble sulphur compounds used in the fertilizer. However, where it is desired to apply additional side-dressings of potash as suggested in paragraph (3) of Section I, the sulphate is perhaps the most suitable form of potash available for this purpose.

(7) *Calcium*—Since fertilizers compounded with high-analysis materials are often low in calcium, it is recommended that tobacco fertilizers carry in an available form a minimum of 6 per cent of calcium oxide (CaO) equivalent.

III. *Neutral Fertilizers:*

If non-acid fertilizers are to be produced, it is suggested that the neutralizing agent be dolomitic limestone, as this material not only neutralizes but carries magnesia (MgO) and calcium (CaO), which are important plant nutrients.

II. *Fertilizers for Dark Tobacco (Sun-cured and Shipping)*

I. *Analyses of Mixtures:*

Use 10 per cent available phosphoric acid, 3 per cent nitrogen, and 4 to 6 per cent potash, 600 to 1,000 pounds per acre. Where manure is used in the rotation, 4 per cent potash in a 600-pound application of a 3-10-4 is usually sufficient.

Note 2—The above analysis may be modified, provided the given ratios are maintained and the recommended sources of plant-food materials are used.

For the first bright-tobacco crop on new land just cleared of trees in the Piedmont section, the writer would like to add one additional fertilizer recommendation. Under such conditions a 3-10-4 mixture might give the most profitable results.

In conclusion the writer would like to emphasize a few points which a summary of results from tobacco tests conducted at Chatham during the last 16 years would show. They are as follows:

I. At least 25 per cent organic nitrogen of plant or animal origin seems safe and profitable for bright-tobacco fertilizers, particularly on leachable soils.

II. No one source of potash should be recommended as a sole source where more than 40 pounds are used per acre. The potash mixture should not generally contain more than 2 per cent chlorine.

III. Under most conditions, the general application of 30 pounds of K_2O or less per acre is not sufficient. The fertilizer mixture should supply 48 to 60 pounds of potash per acre, and in addition to this, extra potash is usually desired, particularly where the potash content is low and leaching is bad. The extra potash should be applied as a side-dressing about 3 weeks after transplanting.

IV. On sandy soils the application of from ½ to ⅔ of the nitrogen and potash before transplanting, and the remainder as a side-dressing

about 3 weeks later, has given increased values of around $25 per acre over a 6-year period.

V. Much larger yields and money values per acre on the average have been obtained from close spacing, high topping, and the priming method of harvest, than from wide spacing, low topping, and harvesting by cutting the whole plant."

Too Goofy to Grumble!

(*From page* 5)

to me that most of our troubles of this era are city-made troubles. Of course we have our occasional rural slums and sore spots, but originally this was not the case, for the great outdoor country is not ordinarily a festering place for injustice and discontent. Only when we get some economic disorders springing up in great consuming centers do we get the backwash of their muddy whirlpool back on the land.

Yet when we of the fresh air zones join hands to right our wrongs or grievances, the first thing we do is to copy some city-hatched scheme and hope to profit thereby, just as we imitate the city slickers in other fads and fashions of the hour.

We planters demand business men's credit terms, mercantile selling methods, high pressure radio campaigns, restrictive output to raise the ante, beauty queen contests to boost our butter and eggs, and every other urban gimcrack except labor unions for the hired man and cigarettes for the old lady!

Sometimes I wish the city dudes would turn around and copy us rubes as we were originally—if they can find any of us situated that way. Things might slide up a peg in the national morale and morals, too. I admit they try to sometimes, because the newspapers say the operators on Wall street dock and shear the spring lambs quite early and often, and a few firms plow under their profits. Beyond this, however, the mob is all looking and rushing in one direction—to pattern after the pavement instead of looking for a solvent in the soil.

I can't figure out the reason why we ruralites should be copying after a passell of humans we often sort of feel sorry for—sorry for the many things their senses are deprived of, largely because they're so used to peering out dead against smoky walls and sickly foliage.

Come to think of it, the folks born and confined forever to the city outnumber the city folks who sometimes come chasing out our way looking for fish worms, mosquito bites, or cheap eggs, seeking the fresh-air cure dressed in plus fours and riding twin sixes. Come to ponder it, there is little wonder that the tenement dwellers think the job and the dollar are the greatest powers in the world and are ready to fight hard for both. Maybe if we country folks had to hand over cash money every time we had a bite to eat or took a little recreation, our minds would get warped about the income problem more than they do.

"THAT ain't livin' " my Father said that time we took a look at the shacks in the ash-alleys back of the stockyards. " 'Taint fittin' for humans," he kept saying all the way back to the loop. He didn't have much money left after selling his hogs and paying for the yardage, feed, and commissions, but Father was so much like that queer old generation of his that I never questioned his attitude or reactions. For instead of losing time and patience grumbling and fussing about low livestock prices, he usually found somebody somehow somewhere who deserved to be pitied and comforted, if possible—at least somebody more than himself.

Now I am aware that the man nowdays who devotes his time to hunting for grief and despair greater than his own brand is apt to be privately designated as a sucker. The women would call him a busybody. Probably he ought to roll up his sleeves and get into the ruthless game with the rest of the snipers. But I feel sure the countryside has more such freaks than we imagine in this age of competition. Maybe a few of them are a wee bit happier than many of the exploiters.

Another member of my queer country clan evinced a quirk in his make-up that holds the key to one of the secrets of our satisfaction in rural life's compensations beyond the dollar mark. This uncle was known widely for his early rising habits and his incessant activity. Be it known that he didn't force this trait on his kinsfolk because he always got his own breakfast and sallied forth with the lark into the fields, alone and indomitable. Neighbors thought he was mercenary and grubbing, but in later years he still retained the custom of beating the sun up o' mornings.

ONE day I asked him why he kept this going when he might take it easy. With a wave of his pipe and a smile at the sunrise, he replied, "For years they called me a durned old toiler and said I was after the almighty dollar; but gosh, I fooled 'em. All I ever wanted was to share the long day with nature and enjoy the sights and sounds around me before it was too late. I always kind of felt folks was born with eyes to see with instead of snoozing over long, and I knew my bed-ridden time would come soon enough, and then the outdoor world would be lost forever."

I also remember visiting with a friendly old farmer one day after the markets had taken an upward flip a couple of years ago. He stood on his porch smiling and looking enchanted over something. I accosted him with the greeting of the day and remarked that I presumed he was grinning at the prospects for twelve-dollar pork and forty-cent butter fat. "Not a bit, mister," he said, hitching up his pants, "I was just feelin' good because the martins have come back and settled in our barn yard in the new house I spent the winter fixin' up for them."

FUNDAMENTALLY of course this general state of goofiness possessed by us hayseeds shows up eternally in our annual confidence in the bounties of nature. No other occupation carries so much of that blissful resumption of tasks where the rewards are so uncertain. Even the ruralites whose lives have been spent in coaxing plant life on barren acres seem to regain a new hope and a new courage every spring. There must be some powerful sedative mixed with some mighty potent stimulant in the alliance of man and nature —something that economists haven't charted.

Again I often conjecture whether we have any right to measure rural success by the same yardsticks and financial goals we use in doping out the achievements of a banker or a lawyer or a merchant. As long as we do follow that identical method of measurement we are going to find so many goofy chaps getting off the track that we are bound to be discouraged. So many folks just farm it because they like to live in the country that I am persuaded that we are making an error sometimes in these hefty surveys and analyses we make at public expense.

Moreover, there is nothing in this way of looking at it which prevents us from keeping our buildings decent, our fields fertilized, and our cattle tested. Just because they use the fiddle to amuse themselves in certain "no account" regions of the countryside is no reason why the fiddle is bad medicine for the more prosperous denizens to adopt. If happiness and success interfere with each other in agriculture, by all means let's get rid of success!

GOOD ACT

Vaudeville Manager: "Why don't you go on with your animal act?"

Lady Trainer: "Pleathe, thir, I can't find my panther."

Vaudeville Manager: "Never mind your clothes, get on with the act."

Jack: "Aw, c-mon, tell me about the new girl of yours."

Bill: "Why should I?"

Jack: "Because I'm your buddy."

Bill: "No siree—my girl ain't no buddy's business."

The Sunday School teacher had been telling the story of spring and the miracle of the growth of the Easter lily.

"Now children," she said, "who can tell me what it is that makes the lily spring from this little bulb?"

"God does it," replied one boy who had learned his lesson well, "but fertilizer helps some."

A hillbilly edged up to the ticket window of a little jerkwater railroad station.

"Mister," he said, "I aims to go to New York to fiddle in Zeb Stewart's Kentucky Band. Can you fix me up for to get there?"

"Certainly," replied the agent. "The Special goes through here in about five minutes, and I can flag her for you—but what about your trunk?"

"Trunk?" asked the puzzled mountaineer. "What's a trunk for?"

"To put your clothes in," replied the agent.

"What!" cried the scandalized hillbilly. "An' me go nekked!"

"Pat, didn't you tell me that a brother of yours is a lawyer?"

"Yis, sor," replied Pat.

"And you a hod carrier? The good things of life are not equally divided, are they?"

"No, sor," said Pat. "Poor fellow—my brother couldn't do this to save his loife."

"Well, I think I'll put the motion before the house," said the chorus girl as she danced out onto the stage.

DEVOTION PLUS

"A pennyworth of liquorice, please, said the little girl.

"I'm afraid I have no liquorice dear," said the sweet shop proprietress. "Must it be liquorice?"

"Yes, I'm afraid it must," replied the child. "You see, our canary is dead and I'm in mourning."

"Do you know what good clean fun is?"

"No, what good is it?"

THREE FINGERS?

Frosh: "Ginger ale."

Waiter: "Pale?"

Frosh: "No, just a glass."

"How does it feel to be marrying an heiress?"

"Great! Every time I kiss her I feel as if I were clipping the coupon off a government bond."

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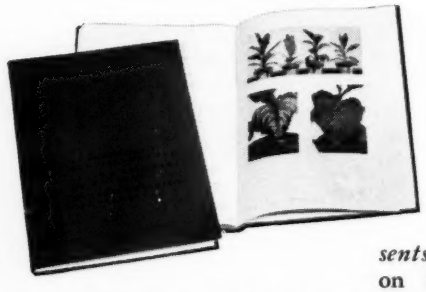

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